

2015-2016

Florida Course

Descriptions for Grades

K-12/Adult, Basic

Education



# Algebra 1 (#1200310)

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**Course Number:** 1200310

**Course Section:** Grades PreK to 12 Education Courses

**Number of Credits:** One credit (1)

**Course Type:** Core

**Course Status :** Draft - Course Pending Approval

**Keywords:** PreK to 12 Education, Pre K to 12 Education, Grades 9 to 12 and Adult Education, 9 to 12, 9-12, High School, Mathematics, Math, Algebra, Algebra 1, ALG 1

**Grade Level(s):** 9, 10, 11, 12

**Course Path: Section:** Grades PreK to 12 Education Courses > **Grade Group:** Grades 9 to 12 and Adult Education Courses > **Subject:** Mathematics > **SubSubject:** Algebra >

**Abbreviated Title:** ALG 1

**Course Length:** Year (Y)

**Course Level:** 2

**Class Size?** Yes

**Grade Level(s) Version:** 9,10,11,12

**Graduation Requirement:** Mathematics

## VERSION DESCRIPTION

The fundamental purpose of this course is to formalize and extend the mathematics that students learned in the middle grades. The critical areas, called units, deepen and extend understanding of linear and exponential relationships by contrasting them with each other and by applying linear models to data that exhibit a linear trend, and students engage in methods for analyzing, solving, and using quadratic functions. The Standards for Mathematical Practice apply throughout each course, and, together with the content standards, prescribe that students experience mathematics

as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations.

**Unit 1- Relationships Between Quantities and Reasoning with Equations:** By the end of eighth grade students have learned to solve linear equations in one variable and have applied graphical and algebraic methods to analyze and solve systems of linear equations in two variables. This unit builds on these earlier experiences by asking students to analyze and explain the process of solving an equation. Students develop fluency writing, interpreting, and translating between various forms of linear equations and inequalities, and using them to solve problems. They master the solution of linear equations and apply related solution techniques and the laws of exponents to the creation and solution of simple exponential equations. All of this work is grounded on understanding quantities and on relationships between them.

**SKILLS TO MAINTAIN:**

Reinforce understanding of the properties of integer exponents. The initial experience with exponential expressions, equations, and functions involves integer exponents and builds on this understanding.

**Unit 2- Linear and Exponential Relationships:** In earlier grades, students define, evaluate, and compare functions, and use them to model relationships between quantities. In this unit, students will learn function notation and develop the concepts of domain and range. They explore many examples of functions, including sequences; they interpret functions given graphically, numerically, symbolically, and verbally, translate between representations, and understand the limitations of various representations. Students build on and informally extend their understanding of integer exponents to consider exponential functions. They compare and contrast linear and exponential functions, distinguishing between additive and multiplicative change. Students explore systems of equations and inequalities, and they find and interpret their solutions. They interpret arithmetic sequences as linear functions and geometric sequences as exponential functions.

**Unit 3- Descriptive Statistics:** This unit builds upon students prior experiences with data, providing students with more formal means of assessing how a model fits data. Students use regression techniques to describe and approximate linear relationships between quantities. They use graphical representations and knowledge of the context to make judgments about the appropriateness of linear models. With linear models, they look at residuals to analyze the goodness of fit.

**Unit 4- Expressions and Equations:** In this unit, students build on their knowledge from unit 2, where they extended the laws of exponents to rational exponents. Students apply this new understanding of number and strengthen their ability to see structure in and create quadratic and exponential expressions. They create and solve equations, inequalities, and systems of equations involving quadratic expressions.

**Unit 5- Quadratic Functions and Modeling:** In this unit, students consider quadratic functions, comparing the key characteristics of quadratic functions to those of linear and exponential functions. They select from among these functions to model phenomena. Students learn to anticipate the graph of a quadratic function by interpreting various forms of quadratic expressions. In particular, they identify the real solutions of a quadratic equation as the zeros of a related quadratic function. Students expand their experience with functions to include more specialized functions—absolute value, step, and those that are piece wise-defined.

## GENERAL NOTES

### Fluency Recommendations

**A/G-** Algebra I students become fluent in solving characteristic problems involving the analytic geometry of lines, such as writing down the equation of a line given a point and a slope. Such fluency can support them in solving less routine mathematical problems involving linearity, as well as in modeling linear phenomena (including modeling using systems of linear inequalities in two variables).

**A-APR.1-** Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in Algebra, as well as in their symbolic work with functions. Manipulation can be more mindful when it is fluent.

**A-SSE.1b-** Fluency in transforming expressions and chunking (seeing parts of an expression as a single object) is essential in factoring, completing the square, and other mindful algebraic calculations.

### English Language Development ELD Standards Special Notes Section:

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic

success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL’s need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:  
<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

### Course Standards

| Name                                | Description   |
|-------------------------------------|---|
| <a href="#">MAFS.912.A-SSE.1.1:</a> | <p>Interpret expressions that represent a quantity in terms of its context. ★</p> <ol style="list-style-type: none"> <li>Interpret parts of an expression, such as terms, factors, and coefficients.</li> <li>Interpret complicated expressions by viewing one or more of their parts as a single entity. <i>For example, interpret <math>P(1+r)^n</math> as the product of <math>P</math> and a factor not depending on <math>P</math>.</i></li> </ol>   |
| <a href="#">MAFS.912.A-SSE.1.2:</a> | <p>Use the structure of an expression to identify ways to rewrite it. <i>For example, see <math>x^4 - y^4</math> as <math>(x^2)^2 - (y^2)^2</math>, thus recognizing it as a difference of squares that can be factored as <math>(x^2 - y^2)(x^2 + y^2)</math>.</i></p>   |
| <a href="#">MAFS.912.A-SSE.2.3:</a> | <p>Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. ★</p> <ol style="list-style-type: none"> <li>Factor a quadratic expression to reveal the zeros of the function it defines.</li> <li>Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.</li> <li>Use the properties of exponents to transform expressions for exponential functions. <i>For example the expression <math>1.15^t</math> can be rewritten as <math>(1.15^{1/12})^{12t} \approx 1.012^{12t}</math> to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.</i></li> </ol> |
| <a href="#">MAFS.912.A-APR.1.1:</a> | <p>Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/> <b>Algebra 1 - Fluency Recommendations</b></p> <p>Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in algebra, as well as in</p> </div>  |

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|  | <p>their symbolic work with functions. Manipulation can be more mindful when it is fluent.</p>  |
| <p><a href="#">MAFS.912.A-APR.2.3:</a></p> | <p>Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.</p>  |
| <p><a href="#">LAFS.910.SL.1.1:</a></p>    | <p>Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.</p> <ol style="list-style-type: none"> <li>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.</li> <li>b. Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed.</li> <li>c. Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.</li> <li>d. Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.</li> </ol> |
| <p><a href="#">MAFS.912.A-CED.1.1:</a></p> | <p>Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational, absolute, and exponential functions. ★</p>   |
| <p><a href="#">LAFS.910.SL.1.2:</a></p>    | <p>Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.</p>   |
| <p><a href="#">MAFS.912.A-CED.1.2:</a></p> | <p>Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. ★</p>  |
| <p><a href="#">LAFS.910.SL.1.3:</a></p>    | <p>Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.</p>  |
| <p><a href="#">MAFS.912.A-CED.1.3:</a></p> | <p>Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. <i>For example, represent inequalities</i></p>   |

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|                                      | describing nutritional and cost constraints on combinations of different foods. ★  |
| <a href="#">LAFS.910.SL.2.4:</a>     | Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.  |
| <a href="#">MAFS.912.A-CED.1.4:</a>  | Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. <i>For example, rearrange Ohm's law <math>V = IR</math> to highlight resistance <math>R</math>.</i> ★  |
| <a href="#">MAFS.912.A-REL.1.1:</a>  | Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.  |
| <a href="#">MAFS.912.A-REL.2.3:</a>  | Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.   |
| <a href="#">MAFS.912.A-REL.2.4:</a>  | Solve quadratic equations in one variable. <ul style="list-style-type: none"> <li>a. Use the method of completing the square to transform any quadratic equation in <math>x</math> into an equation of the form <math>(x - p)^2 = q</math> that has the same solutions. Derive the quadratic formula from this form.</li> <li>b. Solve quadratic equations by inspection (e.g., for <math>x^2 = 49</math>), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as <math>a \pm bi</math> for real numbers <math>a</math> and <math>b</math>.</li> </ul> |
| <a href="#">MAFS.912.A-REL.3.5:</a>  | Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.  |
| <a href="#">MAFS.912.A-REL.3.6:</a>  | Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.   |
| <a href="#">MAFS.912.A-REL.4.10:</a> | Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).  |
| <a href="#">MAFS.912.A-REL.4.11:</a> | Explain why the $x$ -coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$ ; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic  |

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|                                      | functions. ★  |
| <a href="#">MAFS.912.A-REI.4.12:</a> | Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.   |
| <a href="#">MAFS.912.F-IF.1.1:</a>   | Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If $f$ is a function and $x$ is an element of its domain, then $f(x)$ denotes the output of $f$ corresponding to the input $x$ . The graph of $f$ is the graph of the equation $y = f(x)$ .   |
| <a href="#">MAFS.912.F-IF.1.2:</a>   | Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.   |
| <a href="#">MAFS.912.F-IF.1.3:</a>   | Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by $f(0) = f(1) = 1$ , $f(n+1) = f(n) + f(n-1)$ for $n \geq 1$ .  |
| <a href="#">MAFS.912.F-IF.2.4:</a>   | For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. <i>Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</i> ★   |
| <a href="#">MAFS.912.F-IF.2.5:</a>   | Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. <i>For example, if the function <math>h(n)</math> gives the number of person-hours it takes to assemble engines in a factory, then the positive integers would be an appropriate domain for the function.</i> ★  |
| <a href="#">MAFS.912.F-IF.2.6:</a>   | Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. ★  |
| <a href="#">MAFS.912.F-IF.3.8:</a>   | Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. <ul style="list-style-type: none"> <li>a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.</li> <li>b. Use the properties of exponents to interpret expressions for exponential functions. <i>For example, identify percent rate of change in functions such as <math>y = (1.02)^t</math>, <math>y = (0.97)^t</math>, <math>y = (1.01)^{2t}</math>, <math>y = (1.2)^{t/10}</math>, and classify them as representing exponential growth or decay.</i></li> </ul> |



[MAFS.912.F-IF.3.9:](#)

Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*

[MAFS.912.F-BF.1.1:](#)

Write a function that describes a relationship between two quantities. ★

- Determine an explicit expression, a recursive process, or steps for calculation from a context.
- Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*
- Compose functions. *For example, if  $T(y)$  is the temperature in the atmosphere as a function of height, and  $h(t)$  is the height of a weather balloon as a function of time, then  $T(h(t))$  is the temperature at the location of the weather balloon as a function of time.*

[MAFS.912.F-BF.2.3:](#)

Identify the effect on the graph of replacing  $f(x)$  by  $f(x) + k$ ,  $k f(x)$ ,  $f(kx)$ , and  $f(x + k)$  for specific values of  $k$  (both positive and negative); find the value of  $k$  given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.*

[MAFS.912.F-LE.1.1:](#)

Distinguish between situations that can be modeled with linear functions and with exponential functions. ★

- Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.
- Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
- Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

[MAFS.912.F-LE.1.2:](#)

Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). ★

[MAFS.912.F-LE.1.3:](#)

Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. ★

[MAFS.912.F-LE.2.5:](#)

Interpret the parameters in a linear or exponential function in terms of a

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|------------------------------------|---|
|                                    | context. ★  |
| <a href="#">ELD.K12.ELL.1.1:</a>   | English language learners communicate for social and instructional purposes within the school setting.  |
| <a href="#">ELD.K12.ELL.AC.1:</a>  | English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.  |
|                                    | Represent data with plots on the real number line (dot plots, histograms, and box plots). ★   |
| <a href="#">MAFS.912.S-ID.1.1:</a> | <p><b>Remarks/Examples:</b><br/>In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.</p>   |
|                                    | Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. ★  |
| <a href="#">MAFS.912.S-ID.1.2:</a> | <p><b>Remarks/Examples:</b><br/>In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.</p>   |
|                                    | Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). ★  |
| <a href="#">MAFS.912.S-ID.1.3:</a> | <p><b>Remarks/Examples:</b><br/>In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.</p>   |
| <a href="#">MAFS.912.S-ID.2.5:</a> | Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. ★   |
| <a href="#">MAFS.912.S-ID.2.6:</a> | <p>Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. ★</p> <p>a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. <i>Use given functions or choose a function suggested by the context. Emphasize linear, and exponential models.</i></p> |

- b. Informally assess the fit of a function by plotting and analyzing residuals.
- c. Fit a linear function for a scatter plot that suggests a linear association.

**Remarks/Examples:**

Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals.

[MAFS.912.S-ID.3.7:](#)

Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. ★

[MAFS.912.S-ID.3.8:](#)

Compute (using technology) and interpret the correlation coefficient of a linear fit. ★

[MAFS.912.S-ID.3.9:](#)

Distinguish between correlation and causation. ★

[LAFS.910.RST.1.3:](#)

Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

[LAFS.910.RST.2.4:](#)

Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.

[LAFS.910.RST.3.7:](#)

Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

Write arguments focused on *discipline-specific content*.

[LAFS.910.WHST.1.1:](#)

- a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.
- b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience’s knowledge level and concerns.
- c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.
- d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which

they are writing.

- e. Provide a concluding statement or section that follows from or supports the argument presented.

[LAFS.910.WHST.2.4:](#)

Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

[LAFS.910.WHST.3.9:](#)

Draw evidence from informational texts to support analysis, reflection, and research.

[MAFS.K12.MP.1.1:](#)

**Make sense of problems and persevere in solving them.**

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

[MAFS.K12.MP.2.1:](#)

**Reason abstractly and quantitatively.**

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

**Construct viable arguments and critique the reasoning of others.**

[MAFS.K12.MP.3.1:](#)

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

**Model with mathematics.**

[MAFS.K12.MP.4.1:](#)

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

**Use appropriate tools strategically.**

[MAFS.K12.MP.5.1:](#)

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry

software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

**Attend to precision.**

[MAFS.K12.MP.6.1:](#)

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

**Look for and make use of structure.**

[MAFS.K12.MP.7.1:](#)

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

**Look for and express regularity in repeated reasoning.**

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

[MAFS.K12.MP.8.1:](#)

[MAFS.912.N-RN.1.1:](#)

Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. *For example, we define  $5^{1/3}$  to be the cube root of 5 because we want  $(5^{1/3})^3 = 5^{(1/3)3}$  to hold, so  $(5^{1/3})^3$  must equal 5.*

[MAFS.912.N-RN.1.2:](#)

Rewrite expressions involving radicals and rational exponents using the properties of exponents.

[MAFS.912.N-RN.2.3:](#)

Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.

[MAFS.912.N-Q.1.1:](#)

Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.



[MAFS.912.N-Q.1.2:](#)

Define appropriate quantities for the purpose of descriptive modeling. ★

**Remarks/Examples:**

**Algebra 1 Content Notes:**

Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions.

[MAFS.912.N-Q.1.3:](#)

Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. ★

[LAFS.68.WHST.1.1b:](#)

Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.

|                                     |  |
|-------------------------------------|--|
| <a href="#">LAFS.6.L.3.5c:</a>      | Distinguish among the connotations (associations) of words with similar denotations (definitions) (e.g., stingy, scrimping, economical, unwasteful, thrifty).                    |
| <a href="#">MAFS.912.F-IF.3.7a:</a> | a. Graph linear and quadratic functions and show intercepts, maxima, and minima.   |
| <a href="#">MAFS.912.F-IF.3.7b:</a> | b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.   |
| <a href="#">MAFS.912.F-IF.3.7c:</a> | c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.   |
| <a href="#">MAFS.912.F-IF.3.7e:</a> | e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift. |

**There are more than 842 related instructional/educational resources available for this on CPALMS. Click on the following link to access them:**

**<http://www.cpalms.org/PreviewCourse/Preview/13010>**



## **Algebra 1 Honors (#1200320)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 1200320

**Abbreviated Title:** ALG 1 HON

**Number of Credits:** One credit (1)

**Course Length:** Year (Y)

**Honors?** Yes

**Course Type:** Core

**Course Level:** 3

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 9,10,11,12

### **VERSION DESCRIPTION**

The fundamental purpose of this course is to formalize and extend the mathematics that students learned in the middle grades. The critical areas, called units, deepen and extend understanding of linear and exponential relationships by contrasting them with each other and by applying linear models to data that exhibit a linear trend, and students engage in methods for analyzing, solving, and using quadratic functions. The Standards for Mathematical Practice apply throughout each course and, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations.

**Unit 1- Relationships Between Quantities and Reasoning with Equations:** By the end of eighth grade, students have learned to solve linear equations in one variable and have applied graphical and algebraic methods to analyze and solve systems of linear equations in two variables. Now, students analyze and explain the process of solving an equation. Students develop fluency writing, interpreting, and translating between various forms of linear equations and inequalities, and using them to solve problems. They master the solution of linear equations and apply related solution techniques and the laws of exponents to the creation and solution of simple exponential equations.

**Unit 2- Linear and Exponential Relationships:** In earlier grades, students define, evaluate, and compare functions, and use them to model relationships between quantities. In this unit, students will learn function notation and develop the concepts of domain and range. They explore many examples of functions, including sequences; they interpret functions given graphically, numerically, symbolically, and verbally, translate between representations, and understand the limitations of various representations. Students build on and informally extend their understanding of integer exponents to consider exponential functions. They compare and contrast linear and exponential functions, distinguishing between additive and multiplicative change. Students explore systems of equations and inequalities, and they find and interpret their solutions. They interpret

arithmetic sequences as linear functions and geometric sequences as exponential functions.

**Unit 3- Descriptive Statistics:** This unit builds upon students prior experiences with data, providing students with more formal means of assessing how a model fits data. Students use regression techniques to describe and approximate linear relationships between quantities. They use graphical representations and knowledge of the context to make judgments about the appropriateness of linear models. With linear models, they look at residuals to analyze the goodness of fit.

**Unit 4- Expressions and Equations:** In this unit, students build on their knowledge from unit 2, where they extended the laws of exponents to rational exponents. Students apply this new understanding of number and strengthen their ability to see structure in and create quadratic and exponential expressions. They create and solve equations, inequalities, and systems of equations involving quadratic expressions.

**Unit 5- Quadratic Functions and Modeling:** In this unit, students consider quadratic functions, comparing the key characteristics of quadratic functions to those of linear and exponential functions. They select from among these functions to model phenomena. Students learn to anticipate the graph of a quadratic function by interpreting various forms of quadratic expressions. In particular, they identify the real solutions of a quadratic equation as the zeros of a related quadratic function. Students expand their experience with functions to include more specialized functions absolute value, step, and those that are piece wise-defined.

## GENERAL NOTES

### Fluency Recommendations

**A/G-** Algebra I students become fluent in solving characteristic problems involving the analytic geometry of lines, such as writing down the equation of a line given a point and a slope. Such fluency can support them in solving less routine mathematical problems involving linearity, as well as in modeling linear phenomena (including modeling using systems of linear inequalities in two variables).

**A-APR.1-** Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in Algebra, as well as in their symbolic work with functions. Manipulation can be more mindful when it is fluent.

**A-SSE.1b-** Fluency in transforming expressions and chunking (seeing parts of an expression as a single object) is essential in factoring, completing the square, and other mindful algebraic calculations.

**English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL’s need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

**COURSE STANDARDS**

| Name                               | Description   |
|------------------------------------|---|
| <a href="#">MAFS.912.N-RN.1.1:</a> | Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. <i>For example, we define <math>5^{1/3}</math> to be the cube root of 5 because we want <math>(5^{1/3})^3 = 5^{(1/3)3}</math> to hold, so <math>(5^{1/3})^3</math> must equal 5.</i> |
| <a href="#">MAFS.912.N-RN.1.2:</a> | Rewrite expressions involving radicals and rational exponents using the properties of exponents.  |
| <a href="#">MAFS.912.N-RN.2.3:</a> | Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.   |
| <a href="#">MAFS.912.N-Q.1.1:</a>  | Use units as a way to understand problems and to guide the  |

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|                                     | <p>solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. ★</p>  |
| <a href="#">MAFS.912.N-Q.1.2:</a>   | <p>Define appropriate quantities for the purpose of descriptive modeling. ★</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b></p> <p><b>Algebra 1 Content Notes:</b></p> <p>Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions.</p> </div>   |
| <a href="#">MAFS.912.N-Q.1.3:</a>   | <p>Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. ★</p>   |
| <a href="#">MAFS.912.A-SSE.1.1:</a> | <p>Interpret expressions that represent a quantity in terms of its context. ★</p> <ol style="list-style-type: none"> <li>a. Interpret parts of an expression, such as terms, factors, and coefficients.</li> <li>b. Interpret complicated expressions by viewing one or more of their parts as a single entity. <i>For example, interpret <math>P(1+r)^n</math> as the product of <math>P</math> and a factor not depending on <math>P</math>.</i></li> </ol>  |
| <a href="#">MAFS.912.A-SSE.1.2:</a> | <p>Use the structure of an expression to identify ways to rewrite it. <i>For example, see <math>x^4 - y^4</math> as <math>(x^2)^2 - (y^2)^2</math>, thus recognizing it as a difference of squares that can be factored as <math>(x^2 - y^2)(x^2 + y^2)</math>.</i></p>  |
| <a href="#">MAFS.912.A-SSE.2.3:</a> | <p>Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. ★</p> <ol style="list-style-type: none"> <li>a. Factor a quadratic expression to reveal the zeros of the function it defines.</li> <li>b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.</li> <li>c. Use the properties of exponents to transform expressions for exponential functions. <i>For example the expression <math>1.15^t</math> can be rewritten as <math>(1.15^{1/12})^{12t} \approx 1.012^{12t}</math> to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.</i></li> </ol> |
| <a href="#">MAFS.912.A-</a>         | <p>Derive the formula for the sum of a finite geometric series (when</p>   |

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| <a href="#">SSE.2.4:</a>            | the common ratio is not 1), and use the formula to solve problems. <i>For example, calculate mortgage payments.</i> ★   |
| <a href="#">MAFS.912.A-APR.1.1:</a> | Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.<br><div style="border: 1px solid black; padding: 10px; margin-top: 10px;"><b>Remarks/Examples:</b><br/><b>Algebra 1 - Fluency Recommendations</b><br/><br/>Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in algebra, as well as in their symbolic work with functions. Manipulation can be more mindful when it is fluent.</div> |
| <a href="#">MAFS.912.A-APR.2.2:</a> | Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number $a$ , the remainder on division by $x - a$ is $p(a)$ , so $p(a) = 0$ if and only if $(x - a)$ is a factor of $p(x)$ .  |
| <a href="#">MAFS.912.A-APR.2.3:</a> | Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.   |
| <a href="#">MAFS.912.A-APR.3.4:</a> | Prove polynomial identities and use them to describe numerical relationships. For example, the polynomial identity $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ can be used to generate Pythagorean triples.   |
| <a href="#">MAFS.912.A-APR.4.6:</a> | Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x) + r(x)/b(x)$ , where $a(x)$ , $b(x)$ , $q(x)$ , and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$ , using inspection, long division, or, for the more complicated examples, a computer algebra system.  |
| <a href="#">MAFS.912.A-CED.1.1:</a> | Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational, absolute, and exponential functions. ★  |
| <a href="#">MAFS.912.A-CED.1.2:</a> | Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. ★   |
| <a href="#">MAFS.912.A-CED.1.3:</a> | Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. <i>For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.</i> ★  |
| <a href="#">MAFS.912.A-CED.1.4:</a> | Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. <i>For example, rearrange</i>   |

*Ohm's law  $V = IR$  to highlight resistance  $R$ . ★*

[MAFS.912.A-  
REL.1.1:](#)

Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

[MAFS.912.A-  
REL.1.2:](#)

Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

[MAFS.912.A-  
REL.2.3:](#)

Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

[MAFS.912.A-  
REL.2.4:](#)

Solve quadratic equations in one variable.

- a. Use the method of completing the square to transform any quadratic equation in  $x$  into an equation of the form  $(x - p)^2 = q$  that has the same solutions. Derive the quadratic formula from this form.
- b. Solve quadratic equations by inspection (e.g., for  $x^2 = 49$ ), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as  $a \pm bi$  for real numbers  $a$  and  $b$ .

[MAFS.912.A-  
REL.3.5:](#)

Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.

[MAFS.912.A-  
REL.3.6:](#)

Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

[MAFS.912.A-  
REL.3.7:](#)

Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. *For example, find the points of intersection between the line  $y = -3x$  and the circle  $x^2 + y^2 = 3$ .*

[MAFS.912.A-  
REL.4.10:](#)

Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

[MAFS.912.A-  
REL.4.11:](#)

Explain why the  $x$ -coordinates of the points where the graphs of the equations  $y = f(x)$  and  $y = g(x)$  intersect are the solutions of the equation  $f(x) = g(x)$ ; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where  $f(x)$  and/or  $g(x)$  are linear, polynomial, rational, absolute value, exponential,

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|                                      | and logarithmic functions. ★  |
| <a href="#">MAFS.912.A-REI.4.12:</a> | Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.   |
| <a href="#">MAFS.912.F-IF.1.1:</a>   | Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If $f$ is a function and $x$ is an element of its domain, then $f(x)$ denotes the output of $f$ corresponding to the input $x$ . The graph of $f$ is the graph of the equation $y = f(x)$ .   |
| <a href="#">MAFS.912.F-IF.1.2:</a>   | Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.   |
| <a href="#">MAFS.912.F-IF.1.3:</a>   | Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by $f(0) = f(1) = 1$ , $f(n+1) = f(n) + f(n-1)$ for $n \geq 1$ .  |
| <a href="#">MAFS.912.F-IF.2.4:</a>   | For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. <i>Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</i> ★ |
| <a href="#">MAFS.912.F-IF.2.5:</a>   | Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. <i>For example, if the function <math>h(n)</math> gives the number of person-hours it takes to assemble engines in a factory, then the positive integers would be an appropriate domain for the function.</i> ★  |
| <a href="#">MAFS.912.F-IF.2.6:</a>   | Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. ★  |
| <a href="#">MAFS.912.F-IF.3.7:</a>   | Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★ <ul style="list-style-type: none"> <li>a. Graph linear and quadratic functions and show intercepts, maxima, and minima.</li> <li>b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.</li> </ul>            |

- c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.
- d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.
- e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.

Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

[MAFS.912.F-IF.3.8:](#)

- a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
- b. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as  $y = (1.02)^t$ ,  $y = (0.97)^t$ ,  $y = (1.01)^{12t}$ ,  $y = (1.2)^{t/10}$ , and classify them as representing exponential growth or decay.*

[MAFS.912.F-IF.3.9:](#)

Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*

Write a function that describes a relationship between two quantities. ★

[MAFS.912.F-BF.1.1:](#)

- a. Determine an explicit expression, a recursive process, or steps for calculation from a context.
- b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*
- c. Compose functions. *For example, if  $T(y)$  is the temperature in the atmosphere as a function of height, and  $h(t)$  is the height of a weather balloon as a function of time, then  $T(h(t))$  is the temperature at the location of the*



*weather balloon as a function of time.*

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| <a href="#">MAFS.912.F-BF.1.2:</a> | Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. ★  |
| <a href="#">MAFS.912.F-BF.2.3:</a> | Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$ , $kf(x)$ , $f(kx)$ , and $f(x + k)$ for specific values of $k$ (both positive and negative); find the value of $k$ given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. <i>Include recognizing even and odd functions from their graphs and algebraic expressions for them.</i>  |
| <a href="#">MAFS.912.F-BF.2.4:</a> | Find inverse functions.<br><ol style="list-style-type: none"><li>Solve an equation of the form <math>f(x) = c</math> for a simple function <math>f</math> that has an inverse and write an expression for the inverse. <i>For example, <math>f(x) = 2x^3</math> or <math>f(x) = (x+1)/(x-1)</math> for <math>x \neq 1</math>.</i></li><li>Verify by composition that one function is the inverse of another.</li><li>Read values of an inverse function from a graph or a table, given that the function has an inverse.</li><li>Produce an invertible function from a non-invertible function by restricting the domain.</li></ol> |
| <a href="#">MAFS.912.F-LE.1.1:</a> | Distinguish between situations that can be modeled with linear functions and with exponential functions. ★<br><ol style="list-style-type: none"><li>Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.</li><li>Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.</li><li>Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.</li></ol>  |
| <a href="#">MAFS.912.F-LE.1.2:</a> | Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). ★   |
| <a href="#">MAFS.912.F-LE.1.3:</a> | Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. ★  |

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| <a href="#">MAFS.912.F-LE.2.5:</a> | Interpret the parameters in a linear or exponential function in terms of a context. ★  |
| <a href="#">MAFS.912.S-ID.1.1:</a> | <p>Represent data with plots on the real number line (dot plots, histograms, and box plots). ★</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>           In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.</p> </div>   |
| <a href="#">MAFS.912.S-ID.1.2:</a> | <p>Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. ★</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>           In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.</p> </div> |
| <a href="#">MAFS.912.S-ID.1.3:</a> | <p>Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). ★</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>           In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.</p> </div>                                    |
| <a href="#">MAFS.912.S-ID.1.4:</a> | <p>Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. ★</p>  |
| <a href="#">MAFS.912.S-ID.2.5:</a> | <p>Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. ★</p>   |
| <a href="#">MAFS.912.S-ID.2.6:</a> | <p>Represent data on two quantitative variables on a scatter plot, and</p>   |

|   |  |
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|   | <p>describe how the variables are related. ★</p> <ol style="list-style-type: none"> <li>Fit a function to the data; use functions fitted to data to solve problems in the context of the data. <i>Use given functions or choose a function suggested by the context. Emphasize linear, and exponential models.</i></li> <li>Informally assess the fit of a function by plotting and analyzing residuals.</li> <li>Fit a linear function for a scatter plot that suggests a linear association.</li> </ol> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>Remarks/Examples:</b><br/> Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals.</p> </div>  |
| <p><a href="#">MAFS.912.S-ID.3.7:</a></p> | <p>Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. ★</p>  |
| <p><a href="#">MAFS.912.S-ID.3.8:</a></p> | <p>Compute (using technology) and interpret the correlation coefficient of a linear fit. ★</p>   |
| <p><a href="#">MAFS.912.S-ID.3.9:</a></p> | <p>Distinguish between correlation and causation. ★</p>  |
| <p><a href="#">LAFS.910.SL.1.1:</a></p>   | <p>Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.</p> <ol style="list-style-type: none"> <li>Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.</li> <li>Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed.</li> <li>Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.</li> <li>Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when</li> </ol> |

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|                                    | warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.  |
| <a href="#">LAFS.910.SL.1.2:</a>   | Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.  |
| <a href="#">LAFS.910.SL.1.3:</a>   | Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.   |
| <a href="#">LAFS.910.SL.2.4:</a>   | Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.   |
| <a href="#">LAFS.910.RST.1.3:</a>  | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.   |
| <a href="#">LAFS.910.RST.2.4:</a>  | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.   |
| <a href="#">LAFS.910.RST.3.7:</a>  | Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.  |
| <a href="#">LAFS.910.WHST.1.1:</a> | <p>Write arguments focused on <i>discipline-specific content</i>.</p> <ol style="list-style-type: none"> <li>a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.</li> <li>b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience’s knowledge level and concerns.</li> <li>c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.</li> <li>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.</li> <li>e. Provide a concluding statement or section that follows from or supports the argument presented.</li> </ol> |

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| <a href="#">LAFS.910.WHST.2.4:</a> | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.  |
| <a href="#">LAFS.910.WHST.3.9:</a> | Draw evidence from informational texts to support analysis, reflection, and research.   |
| <a href="#">MAFS.K12.MP.1.1:</a>   | <p><b>Make sense of problems and persevere in solving them.</b></p> <p>Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.</p> |
| <a href="#">MAFS.K12.MP.2.1:</a>   | <p><b>Reason abstractly and quantitatively.</b></p> <p>Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.</p>  |

**Construct viable arguments and critique the reasoning of others.**

[MAFS.K12.MP.3.1:](#)

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

**Model with mathematics.**

[MAFS.K12.MP.4.1:](#)

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another.

Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

[MAFS.K12.MP.5.1:](#)

**Use appropriate tools strategically.**

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

**Attend to precision.**

[MAFS.K12.MP.6.1:](#)

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

[MAFS.K12.MP.7.1:](#)

**Look for and make use of structure.**

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure

and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

**Look for and express regularity in repeated reasoning.**

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through  $(1, 2)$  with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

[MAFS.K12.MP.8.1:](#)

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.AC.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.



## **Algebra 2 (#1200330)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 1200330

**Abbreviated Title:** ALG 2

**Number of Credits:** One credit (1)

**Course Length:** Year (Y)

**Course Type:** Core

**Course Level:** 2

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 9,10,11,12

**Graduation Requirement:** Mathematics

### **VERSION DESCRIPTION**

Building on their work with linear, quadratic, and exponential functions, students extend their repertoire of functions to include polynomial, rational, and radical functions. Students work closely with the expressions that define the functions, and continue to expand and hone their abilities to model situations and to solve equations, including solving quadratic equations over the set of complex numbers and solving exponential equations using the properties of logarithms. The Standards for Mathematical Practice apply throughout each course and, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations. The critical areas for this course, organized into four units, are as follows:

**Unit 1- Polynomial, Rational, and Radical Relationships:** This unit develops the structural similarities between the system of polynomials and the system of integers. Students draw on analogies between polynomial arithmetic and base-ten computation, focusing on properties of operations, particularly the distributive property. Students connect multiplication of polynomials with multiplication of multi-digit integers, and division of polynomials with long division of integers. Students identify zeros of polynomials, including complex zeros of quadratic polynomials, and make connections between zeros of polynomials and solutions of polynomial equations. The unit culminates with the fundamental theorem of algebra. A central theme of this unit is that the arithmetic of rational expressions is governed by the same rules as the arithmetic of rational numbers.

**Unit 2- Trigonometric Functions:** Building on their previous work with functions, and on their work with trigonometric ratios and circles in Geometry, students now use the coordinate plane to extend trigonometry to model periodic phenomena.

**Unit 3- Modeling with Functions:** In this unit students synthesize and generalize what they have learned about a variety of function families. They extend their work with exponential functions to include solving exponential equations with logarithms. They

explore the effects of transformations on graphs of diverse functions, including functions arising in an application, in order to abstract the general principle that transformations on a graph always have the same effect regardless of the type of the underlying function. They identify appropriate types of functions to model a situation, they adjust parameters to improve the model, and they compare models by analyzing appropriateness of fit and making judgments about the domain over which a model is a good fit. The description of modeling as “the process of choosing and using mathematics and statistics to analyze empirical situations, to understand them better, and to make decisions” is at the heart of this unit. The narrative discussion and diagram of the modeling cycle should be considered when knowledge of functions, statistics, and geometry is applied in a modeling context.

**Unit 4- Inferences and Conclusions from Data:** In this unit, students see how the visual displays and summary statistics they learned in earlier grades relate to different types of data and to probability distributions. They identify different ways of collecting data—including sample surveys, experiments, and simulations—and the role that randomness and careful design play in the conclusions that can be drawn.

**Unit 5- Applications of Probability:** Building on probability concepts that began in the middle grades, students use the languages of set theory to expand their ability to compute and interpret theoretical and experimental probabilities for compound events, attending to mutually exclusive events, independent events, and conditional probability. Students should make use of geometric probability models wherever possible. They use probability to make informed decisions.

## GENERAL NOTES

### Fluency Recommendations

**A-APR.6** This standard sets an expectation that students will divide polynomials with remainder by inspection in simple cases. For example, one can view the rational expression

$$\frac{x^2 + 5x + 6}{x + 2}$$

**A-SSE.2** The ability to see structure in expressions and to use this structure to rewrite expressions is a key skill in everything from advanced factoring (e.g., grouping) to summing series to the rewriting of rational expressions to examine the end behavior of the corresponding rational function.

**F-IF.3** Fluency in translating between recursive definitions and closed forms is helpful when dealing with many problems involving sequences and series, with applications ranging from fitting functions to tables to problems in finance.

### English Language Development ELD Standards Special Notes Section:

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

### COURSE STANDARDS

| Name                               | Description   |
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| <a href="#">MAFS.912.N-RN.1.1:</a> | Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. <i>For example, we define <math>5^{1/3}</math> to be the cube root of 5 because we want <math>(5^{1/3})^3 = 5^{(1/3)3}</math> to hold, so <math>(5^{1/3})^3</math> must equal 5.</i> |
| <a href="#">MAFS.912.N-RN.1.2:</a> | Rewrite expressions involving radicals and rational exponents using the properties of exponents.  |
| <a href="#">MAFS.912.N-Q.1.2:</a>  | Define appropriate quantities for the purpose of descriptive modeling. ★<br><br><b>Remarks/Examples:</b><br><br><b>Algebra 1 Content Notes:</b><br><br>Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions.   |
| <a href="#">MAFS.912.N-CN.1.1:</a> | Know there is a complex number $i$ such that $i^2 = -1$ , and every complex number has the form $a + bi$ with $a$ and $b$ real.   |
| <a href="#">MAFS.912.N-CN.1.2:</a> | Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.   |
| <a href="#">MAFS.912.N-CN.3.7:</a> | Solve quadratic equations with real coefficients that have  |

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| <p><a href="#">MAFS.912.A-SSE.1.1:</a></p> | <p>complex solutions.</p> <p>Interpret expressions that represent a quantity in terms of its context. ★</p> <ol style="list-style-type: none"> <li>Interpret parts of an expression, such as terms, factors, and coefficients.</li> <li>Interpret complicated expressions by viewing one or more of their parts as a single entity. <i>For example, interpret <math>P(1+r)^n</math> as the product of <math>P</math> and a factor not depending on <math>P</math>.</i></li> </ol>   |
| <p><a href="#">MAFS.912.A-SSE.1.2:</a></p> | <p>Use the structure of an expression to identify ways to rewrite it. <i>For example, see <math>x^4 - y^4</math> as <math>(x^2)^2 - (y^2)^2</math>, thus recognizing it as a difference of squares that can be factored as <math>(x^2 - y^2)(x^2 + y^2)</math>.</i></p>   |
| <p><a href="#">MAFS.912.A-SSE.2.3:</a></p> | <p>Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. ★</p> <ol style="list-style-type: none"> <li>Factor a quadratic expression to reveal the zeros of the function it defines.</li> <li>Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.</li> <li>Use the properties of exponents to transform expressions for exponential functions. <i>For example the expression <math>1.15^t</math> can be rewritten as <math>(1.15^{1/12})^{12t} \approx 1.012^{12t}</math> to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.</i></li> </ol> |
| <p><a href="#">MAFS.912.A-SSE.2.4:</a></p> | <p>Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. <i>For example, calculate mortgage payments.</i> ★</p> <p>Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.</p>  |
| <p><a href="#">MAFS.912.A-APR.1.1:</a></p> | <p><b>Remarks/Examples:</b><br/> <b>Algebra 1 - Fluency Recommendations</b></p> <p>Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in algebra, as well as in their symbolic work with functions. Manipulation can</p>   |

be more mindful when it is fluent.

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| <a href="#">MAFS.912.A-APR.2.2:</a> | Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number $a$ , the remainder on division by $x - a$ is $p(a)$ , so $p(a) = 0$ if and only if $(x - a)$ is a factor of $p(x)$ .   |
| <a href="#">MAFS.912.A-APR.2.3:</a> | Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.  |
| <a href="#">MAFS.912.A-APR.3.4:</a> | Prove polynomial identities and use them to describe numerical relationships. For example, the polynomial identity $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ can be used to generate Pythagorean triples.  |
| <a href="#">MAFS.912.A-APR.4.6:</a> | Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x) + r(x)/b(x)$ , where $a(x)$ , $b(x)$ , $q(x)$ , and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$ , using inspection, long division, or, for the more complicated examples, a computer algebra system. |
| <a href="#">MAFS.912.A-CED.1.1:</a> | Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational, absolute, and exponential functions. ★   |
| <a href="#">MAFS.912.A-CED.1.2:</a> | Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. ★  |
| <a href="#">MAFS.912.A-CED.1.3:</a> | Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. <i>For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.</i> ★                     |
| <a href="#">MAFS.912.A-CED.1.4:</a> | Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. <i>For example, rearrange Ohm's law <math>V = IR</math> to highlight resistance <math>R</math>.</i> ★  |
| <a href="#">MAFS.912.A-REI.1.1:</a> | Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.  |
| <a href="#">MAFS.912.A-REI.1.2:</a> | Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.   |
| <a href="#">MAFS.912.A-REI.2.4:</a> | Solve quadratic equations in one variable.<br>a. Use the method of completing the square to transform any quadratic equation in $x$ into an equation of the form   |

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|                                      | <p><math>(x - p)^2 = q</math> that has the same solutions. Derive the quadratic formula from this form.</p> <p>b. Solve quadratic equations by inspection (e.g., for <math>x^2 = 49</math>), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as <math>a \pm bi</math> for real numbers <math>a</math> and <math>b</math>.</p> |
| <a href="#">MAFS.912.A-REI.3.6:</a>  | Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.   |
| <a href="#">MAFS.912.A-REI.3.7:</a>  | Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. <i>For example, find the points of intersection between the line <math>y = -3x</math> and the circle <math>x^2 + y^2 = 3</math>.</i>  |
| <a href="#">MAFS.912.A-REI.4.11:</a> | Explain why the $x$ -coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$ ; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. ★   |
| <a href="#">MAFS.912.F-IF.2.4:</a>   | For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. <i>Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</i> ★  |
| <a href="#">MAFS.912.F-IF.2.5:</a>   | Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. <i>For example, if the function <math>h(n)</math> gives the number of person-hours it takes to assemble engines in a factory, then the positive integers would be an appropriate domain for the function.</i> ★   |
| <a href="#">MAFS.912.F-IF.2.6:</a>   | Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. ★   |
| <a href="#">MAFS.912.F-IF.3.7:</a>   | Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★  |

- a. Graph linear and quadratic functions and show intercepts, maxima, and minima.
- b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
- c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.
- d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.
- e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.

[MAFS.912.F-IF.3.8:](#)

Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

- a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
- b. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as  $y = (1.02)^t$ ,  $y = (0.97)^t$ ,  $y = (1.01)^{12t}$ ,  $y = (1.2)^{t/10}$ , and classify them as representing exponential growth or decay.*

[MAFS.912.F-IF.3.9:](#)

Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*

[MAFS.912.F-BF.1.1:](#)

Write a function that describes a relationship between two quantities. ★

- a. Determine an explicit expression, a recursive process, or steps for calculation from a context.
- b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant*

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|                                    | <p><i>function to a decaying exponential, and relate these functions to the model.</i></p> <p>c. Compose functions. <i>For example, if <math>T(y)</math> is the temperature in the atmosphere as a function of height, and <math>h(t)</math> is the height of a weather balloon as a function of time, then <math>T(h(t))</math> is the temperature at the location of the weather balloon as a function of time.</i></p>   |
| <a href="#">MAFS.912.F-BF.1.2:</a> | Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. ★  |
| <a href="#">MAFS.912.F-BF.2.3:</a> | Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$ , $k f(x)$ , $f(kx)$ , and $f(x + k)$ for specific values of $k$ (both positive and negative); find the value of $k$ given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. <i>Include recognizing even and odd functions from their graphs and algebraic expressions for them.</i>   |
| <a href="#">MAFS.912.F-BF.2.4:</a> | <p>Find inverse functions.</p> <p>a. Solve an equation of the form <math>f(x) = c</math> for a simple function <math>f</math> that has an inverse and write an expression for the inverse. <i>For example, <math>f(x) = 2x^3</math> or <math>f(x) = (x+1)/(x-1)</math> for <math>x \neq 1</math>.</i></p> <p>b. Verify by composition that one function is the inverse of another.</p> <p>c. Read values of an inverse function from a graph or a table, given that the function has an inverse.</p> <p>d. Produce an invertible function from a non-invertible function by restricting the domain.</p> |
| <a href="#">MAFS.912.F-BF.2.a:</a> | Use the change of base formula.   |
| <a href="#">MAFS.912.F-LE.1.4:</a> | For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where $a$ , $c$ , and $d$ are numbers and the base $b$ is 2, 10, or $e$ ; evaluate the logarithm using technology. ★   |
| <a href="#">MAFS.912.F-LE.2.5:</a> | Interpret the parameters in a linear or exponential function in terms of a context. ★   |
| <a href="#">MAFS.912.F-TF.1.1:</a> | Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle; Convert between degrees and radians.  |
| <a href="#">MAFS.912.F-TF.1.2:</a> | Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.   |



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| <a href="#">MAFS.912.F-TF.2.5:</a>  | Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline. ★   |
| <a href="#">MAFS.912.F-TF.3.8:</a>  | Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to calculate trigonometric ratios.   |
| <a href="#">MAFS.912.G-GPE.1.2:</a> | Derive the equation of a parabola given a focus and directrix.   |
| <a href="#">MAFS.912.S-ID.1.4:</a>  | Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. ★       |
| <a href="#">MAFS.912.S-IC.1.1:</a>  | Understand statistics as a process for making inferences about population parameters based on a random sample from that population. ★  |
| <a href="#">MAFS.912.S-IC.1.2:</a>  | Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. <i>For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?</i>                             |
| <a href="#">MAFS.912.S-IC.2.3:</a>  | Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. ★   |
| <a href="#">MAFS.912.S-IC.2.4:</a>  | Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling. ★   |
| <a href="#">MAFS.912.S-IC.2.5:</a>  | Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. ★  |
| <a href="#">MAFS.912.S-IC.2.6:</a>  | Evaluate reports based on data. ★  |
| <a href="#">MAFS.912.S-CP.1.1:</a>  | Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”). ★  |
| <a href="#">MAFS.912.S-CP.1.2:</a>  | Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent. ★   |
| <a href="#">MAFS.912.S-CP.1.3:</a>  | Understand the conditional probability of A given B as $P(A \text{ and } B)/P(B)$ , and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B. ★ |
| <a href="#">MAFS.912.S-CP.1.4:</a>  | Construct and interpret two-way frequency tables of data when  |

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|                                    | <p>two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. <i>For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.</i> ★</p>  |
| <a href="#">MAFS.912.S-CP.1.5:</a> | <p>Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. <i>For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.</i> ★</p>   |
| <a href="#">MAFS.912.S-CP.2.6:</a> | <p>Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model. ★</p>   |
| <a href="#">MAFS.912.S-CP.2.7:</a> | <p>Apply the Addition Rule, <math>P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)</math>, and interpret the answer in terms of the model. ★</p>  |
| <a href="#">LAFS.910.SL.1.1:</a>   | <p>Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.</p> <ol style="list-style-type: none"> <li>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.</li> <li>b. Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed.</li> <li>c. Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.</li> <li>d. Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.</li> </ol> |
| <a href="#">LAFS.910.SL.1.2:</a>   | <p>Integrate multiple sources of information presented in diverse</p>   |

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|                                     | media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.  |
| <a href="#">LAFS.910.SL.1.3:</a>    | Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.  |
| <a href="#">LAFS.910.SL.2.4:</a>    | Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.  |
| <a href="#">LAFS.1112.RST.1.3:</a>  | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.  |
| <a href="#">LAFS.1112.RST.2.4:</a>  | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.   |
| <a href="#">LAFS.1112.RST.3.7:</a>  | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.  |
|                                     | Write arguments focused on <i>discipline-specific content</i> .  |
| <a href="#">LAFS.1112.WHST.1.1:</a> | <ol style="list-style-type: none"> <li>a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.</li> <li>b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience’s knowledge level, concerns, values, and possible biases.</li> <li>c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.</li> <li>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.</li> <li>e. Provide a concluding statement or section that follows from or supports the argument presented.</li> </ol> |

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| <a href="#">LAFS.1112.WHST.2.4:</a> | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.  |
| <a href="#">LAFS.1112.WHST.3.9:</a> | Draw evidence from informational texts to support analysis, reflection, and research.   |
| <a href="#">MAFS.K12.MP.1.1:</a>    | <p><b>Make sense of problems and persevere in solving them.</b></p> <p>Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.</p> |
| <a href="#">MAFS.K12.MP.2.1:</a>    | <p><b>Reason abstractly and quantitatively.</b></p> <p>Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and</p>   |

flexibly using different properties of operations and objects.

**Construct viable arguments and critique the reasoning of others.**

[MAFS.K12.MP.3.1:](#)

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

**Model with mathematics.**

[MAFS.K12.MP.4.1:](#)

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

**Use appropriate tools strategically.**

[MAFS.K12.MP.5.1:](#)

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

**Attend to precision.**

[MAFS.K12.MP.6.1:](#)

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

**Look for and make use of structure.**

[MAFS.K12.MP.7.1:](#)

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ ,

older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

**Look for and express regularity in repeated reasoning.**

[MAFS.K12.MP.8.1:](#)

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through  $(1, 2)$  with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.AC.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.

## **Algebra 2 Honors (#1200340)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 1200340

**Abbreviated Title:** ALG 2 HON

**Number of Credits:** One credit (1)

**Course Length:** Year (Y)

**Honors?** Yes

**Course Type:** Core

**Course Level:** 3

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 9,10,11,12

**Graduation Requirement:** Mathematics

### **VERSION DESCRIPTION**

Building on their work with linear, quadratic, and exponential functions, students extend their repertoire of functions to include polynomial, rational, and radical functions.<sup>2</sup> Students work closely with the expressions that define the functions, and continue to expand and hone their abilities to model situations and to solve equations, including solving quadratic equations over the set of complex numbers and solving exponential equations using the properties of logarithms. The Mathematical Practice Standards apply throughout each course and, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations. The critical areas for this course, organized into four units, are as follows:

**Unit 1- Polynomial, Rational, and Radical Relationships:** This unit develops the structural similarities between the system of polynomials and the system of integers. Students draw on analogies between polynomial arithmetic and base-ten computation, focusing on properties of operations, particularly the distributive property. Students connect multiplication of polynomials with multiplication of multi-digit integers, and division of polynomials with long division of integers. Students identify zeros of polynomials, including complex zeros of quadratic polynomials, and make connections between zeros of polynomials and solutions of polynomial equations. The unit culminates with the fundamental theorem of algebra. A central theme of this unit is that the arithmetic of rational expressions is governed by the same rules as the arithmetic of rational numbers.

**Unit 2- Trigonometric Functions:** Building on their previous work with functions, and on their work with trigonometric ratios and circles in Geometry, students now use the coordinate plane to extend trigonometry to model periodic phenomena.

**Unit 3- Modeling with Functions:** In this unit students synthesize and generalize what they have learned about a variety of function families. They extend their work with



exponential functions to include solving exponential equations with logarithms. They explore the effects of transformations on graphs of diverse functions, including functions arising in an application, in order to abstract the general principle that transformations on a graph always have the same effect regardless of the type of the underlying function. They identify appropriate types of functions to model a situation, they adjust parameters to improve the model, and they compare models by analyzing appropriateness of fit and making judgments about the domain over which a model is a good fit. The description of modeling as “the process of choosing and using mathematics and statistics to analyze empirical situations, to understand them better, and to make decisions” is at the heart of this unit. The narrative discussion and diagram of the modeling cycle should be considered when knowledge of functions, statistics, and geometry is applied in a modeling context.

**Unit 4- Inferences and Conclusions from Data:** In this unit, students see how the visual displays and summary statistics they learned in earlier grades relate to different types of data and to probability distributions. They identify different ways of collecting data—including sample surveys, experiments, and simulations—and the role that randomness and careful design play in the conclusions that can be drawn.

**Unit 5- Applications of Probability:** Building on probability concepts that began in the middle grades, students use the languages of set theory to expand their ability to compute and interpret theoretical and experimental probabilities for compound events, attending to mutually exclusive events, independent events, and conditional probability. Students should make use of geometric probability models wherever possible. They use probability to make informed decisions.

## GENERAL NOTES

### Fluency Recommendations

**A-APR.6** This standard sets an expectation that students will divide polynomials with remainder by inspection in simple cases. For example, one can view the rational

$$\frac{x+4}{x+3} \text{ as } \frac{x+4}{x+3} = \frac{(x+3)+1}{x+3} = 1 + \frac{1}{x+3}$$

expression .

**A-SSE.2** The ability to see structure in expressions and to use this structure to rewrite expressions is a key skill in everything from advanced factoring (e.g., grouping) to summing series to the rewriting of rational expressions to examine the end behavior of the corresponding rational function.

**F-IF.3** Fluency in translating between recursive definitions and closed forms is helpful when dealing with many problems involving sequences and series, with applications ranging from fitting functions to tables to problems in finance.

**English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL’s need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

**COURSE STANDARDS**

| Name                               | Description   |
|------------------------------------|---|
| <a href="#">MAFS.912.N-RN.1.1:</a> | Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. <i>For example, we define <math>5^{1/3}</math> to be the cube root of 5 because we want <math>(5^{1/3})^3 = 5^{(1/3)3}</math> to hold, so <math>(5^{1/3})^3</math> must equal 5.</i> |
| <a href="#">MAFS.912.N-RN.1.2:</a> | Rewrite expressions involving radicals and rational exponents using the properties of exponents.  |
| <a href="#">MAFS.912.N-Q.1.2:</a>  | Define appropriate quantities for the purpose of descriptive modeling. ★<br><br><b>Remarks/Examples:</b><br><br><b>Algebra 1 Content Notes:</b><br><br>Working with quantities and the relationships between them provides grounding for work with expressions, equations,  |

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|                                     | and functions.  |
| <a href="#">MAFS.912.N-CN.1.1:</a>  | Know there is a complex number $i$ such that $i^2 = -1$ , and every complex number has the form $a + bi$ with $a$ and $b$ real.   |
| <a href="#">MAFS.912.N-CN.1.2:</a>  | Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.   |
| <a href="#">MAFS.912.N-CN.3.7:</a>  | Solve quadratic equations with real coefficients that have complex solutions.   |
| <a href="#">MAFS.912.N-CN.3.8:</a>  | Extend polynomial identities to the complex numbers. <i>For example, rewrite <math>x^2 + 4</math> as <math>(x + 2i)(x - 2i)</math>.</i>   |
| <a href="#">MAFS.912.N-CN.3.9:</a>  | Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.  |
|                                     | Interpret expressions that represent a quantity in terms of its context. ★  |
| <a href="#">MAFS.912.A-SSE.1.1:</a> | <ol style="list-style-type: none"> <li>Interpret parts of an expression, such as terms, factors, and coefficients.</li> <li>Interpret complicated expressions by viewing one or more of their parts as a single entity. <i>For example, interpret <math>P(1+r)^n</math> as the product of <math>P</math> and a factor not depending on <math>P</math>.</i></li> </ol>   |
| <a href="#">MAFS.912.A-SSE.1.2:</a> | Use the structure of an expression to identify ways to rewrite it. <i>For example, see <math>x^4 - y^4</math> as <math>(x^2)^2 - (y^2)^2</math>, thus recognizing it as a difference of squares that can be factored as <math>(x^2 - y^2)(x^2 + y^2)</math>.</i>  |
|                                     | Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. ★  |
| <a href="#">MAFS.912.A-SSE.2.3:</a> | <ol style="list-style-type: none"> <li>Factor a quadratic expression to reveal the zeros of the function it defines.</li> <li>Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.</li> <li>Use the properties of exponents to transform expressions for exponential functions. <i>For example the expression <math>1.15^t</math> can be rewritten as <math>(1.15^{1/12})^{12t} \approx 1.012^{12t}</math> to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.</i></li> </ol> |
| <a href="#">MAFS.912.A-SSE.2.4:</a> | Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve  |

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|                                     | problems. <i>For example, calculate mortgage payments.</i> ★   |
| <a href="#">MAFS.912.A-APR.1.1:</a> | <p>Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/> <b>Algebra 1 - Fluency Recommendations</b></p> <p>Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in algebra, as well as in their symbolic work with functions. Manipulation can be more mindful when it is fluent.</p> </div> |
| <a href="#">MAFS.912.A-APR.2.2:</a> | Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number $a$ , the remainder on division by $x - a$ is $p(a)$ , so $p(a) = 0$ if and only if $(x - a)$ is a factor of $p(x)$ .   |
| <a href="#">MAFS.912.A-APR.2.3:</a> | Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.  |
| <a href="#">MAFS.912.A-APR.3.4:</a> | Prove polynomial identities and use them to describe numerical relationships. For example, the polynomial identity $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ can be used to generate Pythagorean triples.  |
| <a href="#">MAFS.912.A-APR.3.5:</a> | Know and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of $x$ and $y$ for a positive integer $n$ , where $x$ and $y$ are any numbers, with coefficients determined for example by Pascal's Triangle.   |
| <a href="#">MAFS.912.A-APR.4.6:</a> | Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x) + r(x)/b(x)$ , where $a(x)$ , $b(x)$ , $q(x)$ , and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$ , using inspection, long division, or, for the more complicated examples, a computer algebra system.   |
| <a href="#">MAFS.912.A-APR.4.7:</a> | Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.   |
| <a href="#">MAFS.912.A-CED.1.1:</a> | Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational, absolute, and exponential functions. ★   |
| <a href="#">MAFS.912.A-CED.1.2:</a> | Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. ★  |

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| <a href="#">MAFS.912.A-CED.1.3:</a>  | <p>Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. <i>For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.</i> ★</p>   |
| <a href="#">MAFS.912.A-CED.1.4:</a>  | <p>Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. <i>For example, rearrange Ohm's law <math>V = IR</math> to highlight resistance <math>R</math>.</i> ★</p>  |
| <a href="#">MAFS.912.A-REI.1.1:</a>  | <p>Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.</p>  |
| <a href="#">MAFS.912.A-REI.1.2:</a>  | <p>Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.</p>   |
| <a href="#">MAFS.912.A-REI.2.4:</a>  | <p>Solve quadratic equations in one variable.</p> <ol style="list-style-type: none"> <li>Use the method of completing the square to transform any quadratic equation in <math>x</math> into an equation of the form <math>(x - p)^2 = q</math> that has the same solutions. Derive the quadratic formula from this form.</li> <li>Solve quadratic equations by inspection (e.g., for <math>x^2 = 49</math>), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as <math>a \pm bi</math> for real numbers <math>a</math> and <math>b</math>.</li> </ol> |
| <a href="#">MAFS.912.A-REI.3.6:</a>  | <p>Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.</p>   |
| <a href="#">MAFS.912.A-REI.3.7:</a>  | <p>Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. <i>For example, find the points of intersection between the line <math>y = -3x</math> and the circle <math>x^2 + y^2 = 3</math>.</i></p>  |
| <a href="#">MAFS.912.A-REI.4.11:</a> | <p>Explain why the <math>x</math>-coordinates of the points where the graphs of the equations <math>y = f(x)</math> and <math>y = g(x)</math> intersect are the solutions of the equation <math>f(x) = g(x)</math>; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where <math>f(x)</math> and/or <math>g(x)</math> are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. ★</p>   |

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| <p><a href="#">MAFS.912.F-IF.2.4:</a></p> | <p>For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. <i>Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</i> ★</p>  |
| <p><a href="#">MAFS.912.F-IF.2.5:</a></p> | <p>Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. <i>For example, if the function <math>h(n)</math> gives the number of person-hours it takes to assemble engines in a factory, then the positive integers would be an appropriate domain for the function.</i> ★</p>   |
| <p><a href="#">MAFS.912.F-IF.2.6:</a></p> | <p>Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. ★</p>   |
| <p><a href="#">MAFS.912.F-IF.3.7:</a></p> | <p>Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★</p> <ol style="list-style-type: none"> <li>Graph linear and quadratic functions and show intercepts, maxima, and minima.</li> <li>Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.</li> <li>Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.</li> <li>Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.</li> <li>Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.</li> </ol> |
| <p><a href="#">MAFS.912.F-IF.3.8:</a></p> | <p>Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.</p> <ol style="list-style-type: none"> <li>Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.</li> <li>Use the properties of exponents to interpret expressions for exponential functions. <i>For example, identify percent</i></li> </ol>  |

rate of change in functions such as  $y = (1.02)^t$ ,  $y = (0.97)^t$ ,  $y = (1.0)^{2t}$ ,  $y = (1.2)^{t/10}$ , and classify them as representing exponential growth or decay.

[MAFS.912.F-IF.3.9:](#)

Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*

[MAFS.912.F-BF.1.1:](#)

Write a function that describes a relationship between two quantities. ★

- Determine an explicit expression, a recursive process, or steps for calculation from a context.
- Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*
- Compose functions. *For example, if  $T(y)$  is the temperature in the atmosphere as a function of height, and  $h(t)$  is the height of a weather balloon as a function of time, then  $T(h(t))$  is the temperature at the location of the weather balloon as a function of time.*

[MAFS.912.F-BF.1.2:](#)

Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. ★

[MAFS.912.F-BF.2.3:](#)

Identify the effect on the graph of replacing  $f(x)$  by  $f(x) + k$ ,  $k f(x)$ ,  $f(kx)$ , and  $f(x + k)$  for specific values of  $k$  (both positive and negative); find the value of  $k$  given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.*

[MAFS.912.F-BF.2.4:](#)

Find inverse functions.

- Solve an equation of the form  $f(x) = c$  for a simple function  $f$  that has an inverse and write an expression for the inverse. *For example,  $f(x) = 2x^3$  or  $f(x) = (x+1)/(x-1)$  for  $x \neq 1$ .*
- Verify by composition that one function is the inverse of

- another.
- c. Read values of an inverse function from a graph or a table, given that the function has an inverse.
  - d. Produce an invertible function from a non-invertible function by restricting the domain.

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| <a href="#">MAFS.912.F-BF.2.a:</a>  | Use the change of base formula.  |
| <a href="#">MAFS.912.F-LE.1.4:</a>  | For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology. ★   |
| <a href="#">MAFS.912.F-LE.2.5:</a>  | Interpret the parameters in a linear or exponential function in terms of a context. ★  |
| <a href="#">MAFS.912.F-TF.1.1:</a>  | Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle; Convert between degrees and radians.   |
| <a href="#">MAFS.912.F-TF.1.2:</a>  | Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.  |
| <a href="#">MAFS.912.F-TF.2.5:</a>  | Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline. ★   |
| <a href="#">MAFS.912.F-TF.3.8:</a>  | Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to calculate trigonometric ratios.   |
| <a href="#">MAFS.912.G-GPE.1.2:</a> | Derive the equation of a parabola given a focus and directrix.   |
| <a href="#">MAFS.912.S-ID.1.4:</a>  | Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. ★ |
| <a href="#">MAFS.912.S-IC.1.1:</a>  | Understand statistics as a process for making inferences about population parameters based on a random sample from that population. ★  |
| <a href="#">MAFS.912.S-IC.1.2:</a>  | Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. <i>For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?</i>                       |
| <a href="#">MAFS.912.S-IC.2.3:</a>  | Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. ★   |
| <a href="#">MAFS.912.S-IC.2.4:</a>  | Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of  |



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|                                    | simulation models for random sampling. ★  |
| <a href="#">MAFS.912.S-IC.2.5:</a> | Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. ★   |
| <a href="#">MAFS.912.S-IC.2.6:</a> | Evaluate reports based on data. ★   |
| <a href="#">MAFS.912.S-CP.1.1:</a> | Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”). ★   |
| <a href="#">MAFS.912.S-CP.1.2:</a> | Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent. ★  |
| <a href="#">MAFS.912.S-CP.1.3:</a> | Understand the conditional probability of A given B as $P(A \text{ and } B)/P(B)$ , and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B. ★  |
| <a href="#">MAFS.912.S-CP.1.4:</a> | Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. <i>For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.</i> ★ |
| <a href="#">MAFS.912.S-CP.1.5:</a> | Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. <i>For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.</i> ★  |
| <a href="#">MAFS.912.S-CP.2.6:</a> | Find the conditional probability of A given B as the fraction of B’s outcomes that also belong to A, and interpret the answer in terms of the model. ★  |
| <a href="#">MAFS.912.S-CP.2.7:</a> | Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ , and interpret the answer in terms of the model. ★   |
| <a href="#">MAFS.912.S-CP.2.8:</a> | Apply the general Multiplication Rule in a uniform probability model, $P(A \text{ and } B) = P(A)P(B A) = P(B)P(A B)$ , and interpret the answer in terms of the model. ★   |
| <a href="#">MAFS.912.S-CP.2.9:</a> | Use permutations and combinations to compute probabilities of   |

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|                                    | compound events and solve problems. ★   |
| <a href="#">MAFS.912.S-MD.2.6:</a> | Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator). ★  |
| <a href="#">MAFS.912.S-MD.2.7:</a> | Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game). ★   |
| <a href="#">LAFS.1112.SL.1.1:</a>  | <p>Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.</p> <ol style="list-style-type: none"> <li>Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.</li> <li>Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.</li> <li>Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.</li> <li>Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task.</li> </ol> |
| <a href="#">LAFS.1112.SL.1.2:</a>  | Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.   |
| <a href="#">LAFS.1112.SL.1.3:</a>  | Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used.   |
| <a href="#">LAFS.1112.SL.2.4:</a>  | Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.   |

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| <a href="#">LAFS.1112.RST.1.3:</a>  | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.  |
| <a href="#">LAFS.1112.RST.2.4:</a>  | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.   |
| <a href="#">LAFS.1112.RST.3.7:</a>  | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.  |
| <a href="#">LAFS.1112.WHST.1.1:</a> | <p>Write arguments focused on <i>discipline-specific content</i>.</p> <ol style="list-style-type: none"> <li>a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.</li> <li>b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience’s knowledge level, concerns, values, and possible biases.</li> <li>c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.</li> <li>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.</li> <li>e. Provide a concluding statement or section that follows from or supports the argument presented.</li> </ol> |
| <a href="#">LAFS.1112.WHST.2.4:</a> | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.   |
| <a href="#">LAFS.1112.WHST.3.9:</a> | Draw evidence from informational texts to support analysis, reflection, and research.  |
| <a href="#">MAFS.K12.MP.1.1:</a>    | <p><b>Make sense of problems and persevere in solving them.</b></p> <p>Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry</p>   |

points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

**Reason abstractly and quantitatively.**

[MAFS.K12.MP.2.1:](#)

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

[MAFS.K12.MP.3.1:](#)

**Construct viable arguments and critique the reasoning of others.**

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They

justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

**Model with mathematics.**

[MAFS.K12.MP.4.1:](#)

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

[MAFS.K12.MP.5.1:](#)

**Use appropriate tools strategically.**

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and

their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

**Attend to precision.**

[MAFS.K12.MP.6.1:](#)

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

**Look for and make use of structure.**

[MAFS.K12.MP.7.1:](#)

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

**Look for and express regularity in repeated reasoning.**

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

[MAFS.K12.MP.8.1:](#)

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.AC.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.

## **Algebra 1-A (#1200370)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 1200370

**Abbreviated Title:** ALG 1-A

**Number of Credits:** One credit (1)

**Course Length:** Year (Y)

**Course Type:** Core

**Course Level:** 2

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 9,10,11,12

### **VERSION DESCRIPTION**

The fundamental purpose of this course is to formalize and extend the mathematics that students learned in the middle grades. The critical areas, called units, deepen and extend understanding of linear and exponential relationships by contrasting them with each other and by applying linear models to data that exhibit a linear trend, and students engage in methods for analyzing, solving, and using quadratic functions. The Standards for Mathematical Practice apply throughout each course and, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations.

### **Algebra 1A (Year 1)**

**Unit 1- Relationships Between Quantities and Reasoning with Equations:** By the end of eighth grade, students have learned to solve linear equations in one variable and have applied graphical and algebraic methods to analyze and solve systems of linear equations in two variables. Now, students analyze and explain the process of solving an equation. Students develop fluency writing, interpreting, and translating between various forms of linear equations and inequalities, and using them to solve problems. They master the solution of linear equations and apply related solution techniques and the laws of exponents to the creation and solution of simple exponential equations.

**Unit 2- Linear and Exponential Relationships:** In earlier grades, students define, evaluate, and compare functions, and use them to model relationships between quantities. In this unit, students will learn function notation and develop the concepts of domain and range. They explore many examples of functions, including sequences; they interpret functions given graphically, numerically, symbolically, and verbally, translate between representations, and understand the limitations of various representations. Students build on and informally extend their understanding of integer exponents to consider exponential functions. They compare and contrast linear and exponential functions, distinguishing between additive and multiplicative change. Students explore systems of equations and inequalities, and they find and interpret their solutions. They interpret arithmetic sequences as linear functions and geometric sequences as exponential



functions.

## **Algebra 1B (Year 2)**

**Unit 3- Descriptive Statistics:** This unit builds upon students' prior experiences with data, providing students with more formal means of assessing how a model fits data. Students use regression techniques to describe and approximate linear relationships between quantities. They use graphical representations and knowledge of the context to make judgments about the appropriateness of linear models. With linear models, they look at residuals to analyze the goodness of fit.

**Unit 4- Expressions and Equations:** In this unit, students build on their knowledge from unit 2, where they extended the laws of exponents to rational exponents. Students apply this new understanding of number and strengthen their ability to see structure in and create quadratic and exponential expressions. They create and solve equations, inequalities, and systems of equations involving quadratic expressions.

**Unit 5- Quadratic Functions and Modeling:** In this unit, students consider quadratic functions, comparing the key characteristics of quadratic functions to those of linear and exponential functions. They select from among these functions to model phenomena. Students learn to anticipate the graph of a quadratic function by interpreting various forms of quadratic expressions. In particular, they identify the real solutions of a quadratic equation as the zeros of a related quadratic function. Students expand their experience with functions to include more specialized functions—absolute value, step, and those that are piecewise-defined.

## **GENERAL NOTES**

### **Fluency Recommendations**

**A/G-** Algebra I students become fluent in solving characteristic problems involving the analytic geometry of lines, such as writing down the equation of a line given a point and a slope. Such fluency can support them in solving less routine mathematical problems involving linearity, as well as in modeling linear phenomena (including modeling using systems of linear inequalities in two variables).

**A-APR.1-** Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in Algebra, as well as in their symbolic work with functions. Manipulation can be more mindful when it is fluent.

**A-SSE.1b-** Fluency in transforming expressions and chunking (seeing parts of an expression as a single object) is essential in factoring, completing the square, and other mindful algebraic calculations.

### **English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that

allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

## COURSE STANDARDS

| Name                               | Description  |
|------------------------------------|--|
| <a href="#">MAFS.912.N-RN.1.1:</a> | <p>Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. <i>For example, we define <math>5^{1/3}</math> to be the cube root of 5 because we want <math>(5^{1/3})^3 = 5^{(1/3)3}</math> to hold, so <math>(5^{1/3})^3</math> must equal 5.</i></p> |
| <a href="#">MAFS.912.N-RN.1.2:</a> | <p>Rewrite expressions involving radicals and rational exponents using the properties of exponents.</p>  |
| <a href="#">MAFS.912.N-Q.1.1:</a>  | <p>Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. ★</p>   |
| <a href="#">MAFS.912.N-Q.1.2:</a>  | <p>Define appropriate quantities for the purpose of descriptive modeling. ★</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b></p> <p><b>Algebra 1 Content Notes:</b></p> <p>Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions.</p> </div>   |
| <a href="#">MAFS.912.N-Q.1.3:</a>  | <p>Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. ★</p>   |

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| <a href="#">MAFS.912.A-SSE.1.1:</a>  | <p>Interpret expressions that represent a quantity in terms of its context. ★</p> <ol style="list-style-type: none"> <li>Interpret parts of an expression, such as terms, factors, and coefficients.</li> <li>Interpret complicated expressions by viewing one or more of their parts as a single entity. <i>For example,</i><br/>interpret <math>P(1+r)^n</math> as the product of <math>P</math> and a factor not depending on <math>P</math>.</li> </ol> |
| <a href="#">MAFS.912.A-CED.1.1:</a>  | <p>Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational, absolute, and exponential functions. ★</p>   |
| <a href="#">MAFS.912.A-CED.1.2:</a>  | <p>Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. ★</p>  |
| <a href="#">MAFS.912.A-CED.1.3:</a>  | <p>Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. <i>For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.</i> ★</p>   |
| <a href="#">MAFS.912.A-CED.1.4:</a>  | <p>Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. <i>For example, rearrange Ohm's law <math>V = IR</math> to highlight resistance <math>R</math>.</i> ★</p>  |
| <a href="#">MAFS.912.A-REI.1.1:</a>  | <p>Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.</p>  |
| <a href="#">MAFS.912.A-REI.2.3:</a>  | <p>Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.</p>   |
| <a href="#">MAFS.912.A-REI.3.5:</a>  | <p>Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.</p>  |
| <a href="#">MAFS.912.A-REI.3.6:</a>  | <p>Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.</p>   |
| <a href="#">MAFS.912.A-REI.4.10:</a> | <p>Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).</p>  |

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| <a href="#">MAFS.912.A-REI.4.11:</a> | <p>Explain why the x-coordinates of the points where the graphs of the equations <math>y = f(x)</math> and <math>y = g(x)</math> intersect are the solutions of the equation <math>f(x) = g(x)</math>; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where <math>f(x)</math> and/or <math>g(x)</math> are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. ★</p> |
| <a href="#">MAFS.912.A-REI.4.12:</a> | <p>Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.</p>   |
| <a href="#">MAFS.912.F-IF.1.1:</a>   | <p>Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If <math>f</math> is a function and <math>x</math> is an element of its domain, then <math>f(x)</math> denotes the output of <math>f</math> corresponding to the input <math>x</math>. The graph of <math>f</math> is the graph of the equation <math>y = f(x)</math>.</p>  |
| <a href="#">MAFS.912.F-IF.1.2:</a>   | <p>Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.</p>   |
| <a href="#">MAFS.912.F-IF.1.3:</a>   | <p>Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by <math>f(0) = f(1) = 1</math>, <math>f(n+1) = f(n) + f(n-1)</math> for <math>n \geq 1</math>.</p>   |
| <a href="#">MAFS.912.F-IF.2.4:</a>   | <p>For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. <i>Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</i> ★</p>   |
| <a href="#">MAFS.912.F-IF.2.5:</a>   | <p>Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. <i>For example, if the function <math>h(n)</math> gives the number of person-hours it takes to assemble engines in a factory, then the positive integers would be an appropriate domain for the function.</i> ★</p>  |
| <a href="#">MAFS.912.F-IF.2.6:</a>   | <p>Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. ★</p>  |
| <a href="#">MAFS.912.F-IF.3.7:</a>   | <p>Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★</p>   |

- a. Graph linear and quadratic functions and show intercepts, maxima, and minima.
- b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
- c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.
- d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.
- e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.

[MAFS.912.F-IF.3.9:](#)

Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*

[MAFS.912.F-BF.1.1:](#)

Write a function that describes a relationship between two quantities. ★

- a. Determine an explicit expression, a recursive process, or steps for calculation from a context.
- b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*
- c. Compose functions. *For example, if  $T(y)$  is the temperature in the atmosphere as a function of height, and  $h(t)$  is the height of a weather balloon as a function of time, then  $T(h(t))$  is the temperature at the location of the weather balloon as a function of time.*

[MAFS.912.F-BF.2.3:](#)

Identify the effect on the graph of replacing  $f(x)$  by  $f(x) + k$ ,  $k f(x)$ ,  $f(kx)$ , and  $f(x + k)$  for specific values of  $k$  (both positive and negative); find the value of  $k$  given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.*

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| <p><a href="#">MAFS.912.F-LE.1.1:</a></p> | <p>Distinguish between situations that can be modeled with linear functions and with exponential functions. ★</p> <ol style="list-style-type: none"> <li>a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.</li> <li>b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.</li> <li>c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.</li> </ol>   |
| <p><a href="#">MAFS.912.F-LE.1.2:</a></p> | <p>Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). ★</p>  |
| <p><a href="#">MAFS.912.F-LE.1.3:</a></p> | <p>Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. ★</p>   |
| <p><a href="#">MAFS.912.F-LE.2.5:</a></p> | <p>Interpret the parameters in a linear or exponential function in terms of a context. ★</p>  |
| <p><a href="#">LAFS.910.SL.1.1:</a></p>   | <p>Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.</p> <ol style="list-style-type: none"> <li>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.</li> <li>b. Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed.</li> <li>c. Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.</li> <li>d. Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the</li> </ol> |

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|                                    | evidence and reasoning presented.   |
| <a href="#">LAFS.910.SL.1.2:</a>   | Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.  |
| <a href="#">LAFS.910.SL.1.3:</a>   | Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.   |
| <a href="#">LAFS.910.SL.2.4:</a>   | Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.   |
| <a href="#">LAFS.910.RST.1.3:</a>  | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.   |
| <a href="#">LAFS.910.RST.2.4:</a>  | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.   |
| <a href="#">LAFS.910.RST.3.7:</a>  | Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.  |
|                                    | Write arguments focused on <i>discipline-specific content</i> .   |
| <a href="#">LAFS.910.WHST.1.1:</a> | <ol style="list-style-type: none"> <li>a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.</li> <li>b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience’s knowledge level and concerns.</li> <li>c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.</li> <li>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.</li> <li>e. Provide a concluding statement or section that follows from or supports the argument presented.</li> </ol> |
| <a href="#">LAFS.910.WHST.2.4:</a> | Produce clear and coherent writing in which the development,  |

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|                                    | organization, and style are appropriate to task, purpose, and audience.   |
| <a href="#">LAFS.910.WHST.3.9:</a> | Draw evidence from informational texts to support analysis, reflection, and research.   |
| <a href="#">MAFS.K12.MP.1.1:</a>   | <p><b>Make sense of problems and persevere in solving them.</b></p> <p>Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.</p> |
| <a href="#">MAFS.K12.MP.2.1:</a>   | <p><b>Reason abstractly and quantitatively.</b></p> <p>Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.</p>  |
| <a href="#">MAFS.K12.MP.3.1:</a>   | <b>Construct viable arguments and critique the reasoning of</b>   |



**others.**

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

**Model with mathematics.**

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another.

[MAFS.K12.MP.4.1:](#)

Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

[MAFS.K12.MP.5.1:](#)

**Use appropriate tools strategically.**

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

**Attend to precision.**

[MAFS.K12.MP.6.1:](#)

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

**Look for and make use of structure.**

[MAFS.K12.MP.7.1:](#)

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving

problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

**Look for and express regularity in repeated reasoning.**

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through  $(1, 2)$  with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

[MAFS.K12.MP.8.1:](#)

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.AC.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.

## **Algebra 1-B (#1200380)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 1200380

**Abbreviated Title:** ALG 1-B

**Number of Credits:** One credit (1)

**Course Type:** Core

**Course Level:** 2

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 9,10,11,12

### **VERSION DESCRIPTION**

The fundamental purpose of this course is to formalize and extend the mathematics that students learned in the middle grades. The critical areas, called units, deepen and extend understanding of linear and exponential relationships by contrasting them with each other and by applying linear models to data that exhibit a linear trend, and students engage in methods for analyzing, solving, and using quadratic functions. The Standards for Mathematical Practice apply throughout each course and, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations.

### **Algebra 1A (Year 1)**

**Unit 1- Relationships Between Quantities and Reasoning with Equations:** By the end of eighth grade, students have learned to solve linear equations in one variable and have applied graphical and algebraic methods to analyze and solve systems of linear equations in two variables. Now, students analyze and explain the process of solving an equation. Students develop fluency writing, interpreting, and translating between various forms of linear equations and inequalities, and using them to solve problems. They master the solution of linear equations and apply related solution techniques and the laws of exponents to the creation and solution of simple exponential equations.

**Unit 2- Linear and Exponential Relationships:** In earlier grades, students define, evaluate, and compare functions, and use them to model relationships between quantities. In this unit, students will learn function notation and develop the concepts of domain and range. They explore many examples of functions, including sequences; they interpret functions given graphically, numerically, symbolically, and verbally, translate between representations, and understand the limitations of various representations. Students build on and informally extend their understanding of integer exponents to consider exponential functions. They compare and contrast linear and exponential functions,

distinguishing between additive and multiplicative change. Students explore systems of equations and inequalities, and they find and interpret their solutions. They interpret arithmetic sequences as linear functions and geometric sequences as exponential functions.

## **Algebra 1B (Year 2)**

**Unit 3- Descriptive Statistics:** This unit builds upon students' prior experiences with data, providing students with more formal means of assessing how a model fits data. Students use regression techniques to describe and approximate linear relationships between quantities. They use graphical representations and knowledge of the context to make judgments about the appropriateness of linear models. With linear models, they look at residuals to analyze the goodness of fit.

**Unit 4- Expressions and Equations:** In this unit, students build on their knowledge from unit 2, where they extended the laws of exponents to rational exponents. Students apply this new understanding of number and strengthen their ability to see structure in and create quadratic and exponential expressions. They create and solve equations, inequalities, and systems of equations involving quadratic expressions.

**Unit 5- Quadratic Functions and Modeling:** In this unit, students consider quadratic functions, comparing the key characteristics of quadratic functions to those of linear and exponential functions. They select from among these functions to model phenomena. Students learn to anticipate the graph of a quadratic function by interpreting various forms of quadratic expressions. In particular, they identify the real solutions of a quadratic equation as the zeros of a related quadratic function. Students expand their experience with functions to include more specialized functions—absolute value, step, and those that are piece wise-defined.

## **GENERAL NOTES**

### **Fluency Recommendations**

**A/G-** Algebra I students become fluent in solving characteristic problems involving the analytic geometry of lines, such as writing down the equation of a line given a point and a slope. Such fluency can support them in solving less routine mathematical problems involving linearity, as well as in modeling linear phenomena (including modeling using systems of linear inequalities in two variables).

**A-APR.1-** Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in Algebra, as well as in their symbolic work with functions. Manipulation can be more mindful when it is fluent.

**A-SSE.1b-** Fluency in transforming expressions and chunking (seeing parts of an expression as a single object) is essential in factoring, completing the square, and other mindful algebraic calculations.

**English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL’s need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

**COURSE STANDARDS**

| Name                                | Description   |
|-------------------------------------|---|
| <a href="#">MAFS.912.N-RN.2.3:</a>  | Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.   |
| <a href="#">MAFS.912.A-SSE.1.1:</a> | Interpret expressions that represent a quantity in terms of its context. ★<br><br>a. Interpret parts of an expression, such as terms, factors, and coefficients.<br>b. Interpret complicated expressions by viewing one or more of their parts as a single entity. <i>For example,</i><br><br><i>interpret <math>P(1+r)^n</math> as the product of P and a factor not</i> |

|                                     |  |
|-------------------------------------|--|
|                                     | <i>depending on P.</i>   |
| <a href="#">MAFS.912.A-SSE.1.2:</a> | Use the structure of an expression to identify ways to rewrite it. <i>For example, see <math>x^4 - y^4</math> as <math>(x^2)^2 - (y^2)^2</math>, thus recognizing it as a difference of squares that can be factored as <math>(x^2 - y^2)(x^2 + y^2)</math>.</i>   |
| <a href="#">MAFS.912.A-SSE.2.3:</a> | Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. ★<br><br>a. Factor a quadratic expression to reveal the zeros of the function it defines.<br>b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.<br>c. Use the properties of exponents to transform expressions for exponential functions. <i>For example the expression <math>1.15^t</math> can be rewritten as <math>(1.15^{1/12})^{12t} \approx 1.012^{12t}</math> to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.</i> |
| <a href="#">MAFS.912.A-APR.1.1:</a> | Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.<br><br><div style="border: 1px solid black; padding: 10px;"> <p><b>Remarks/Examples:</b><br/> <b>Algebra 1 - Fluency Recommendations</b></p> <p>Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in algebra, as well as in their symbolic work with functions. Manipulation can be more mindful when it is fluent.</p> </div>  |
| <a href="#">MAFS.912.A-APR.2.3:</a> | Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.  |
| <a href="#">MAFS.912.A-CED.1.1:</a> | Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational, absolute, and exponential functions. ★   |
| <a href="#">MAFS.912.A-CED.1.2:</a> | Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. ★  |

[MAFS.912.A-  
CED.1.4:](#)

Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law  $V = IR$  to highlight resistance  $R$ .* ★

[MAFS.912.A-  
REI.2.4:](#)

Solve quadratic equations in one variable.

- a. Use the method of completing the square to transform any quadratic equation in  $x$  into an equation of the form  $(x - p)^2 = q$  that has the same solutions. Derive the quadratic formula from this form.
- b. Solve quadratic equations by inspection (e.g., for  $x^2 = 49$ ), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as  $a \pm bi$  for real numbers  $a$  and  $b$ .

[MAFS.912.F-IF.2.4:](#)

For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.* ★

[MAFS.912.F-IF.2.5:](#)

Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function  $h(n)$  gives the number of person-hours it takes to assemble engines in a factory, then the positive integers would be an appropriate domain for the function.* ★

[MAFS.912.F-IF.2.6:](#)

Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. ★

[MAFS.912.F-IF.3.7:](#)

Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★

- a. Graph linear and quadratic functions and show intercepts, maxima, and minima.
- b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
- c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.
- d. Graph rational functions, identifying zeros and asymptotes



- when suitable factorizations are available, and showing end behavior.
- e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.

Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

[MAFS.912.F-IF.3.8:](#)

- a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
- b. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as  $y = (1.02)^t$ ,  $y = (0.97)^t$ ,  $y = (1.01)^{2t}$ ,  $y = (1.2)^{t/10}$ , and classify them as representing exponential growth or decay.*

[MAFS.912.F-IF.3.9:](#)

Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*

Write a function that describes a relationship between two quantities. ★

[MAFS.912.F-BF.1.1:](#)

- a. Determine an explicit expression, a recursive process, or steps for calculation from a context.
- b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*
- c. Compose functions. *For example, if  $T(y)$  is the temperature in the atmosphere as a function of height, and  $h(t)$  is the height of a weather balloon as a function of time, then  $T(h(t))$  is the temperature at the location of the weather balloon as a function of time.*

|   |   |
|---|---|
| <p><a href="#">MAFS.912.F-BF.2.3:</a></p> | <p>Identify the effect on the graph of replacing <math>f(x)</math> by <math>f(x) + k</math>, <math>kf(x)</math>, <math>f(kx)</math>, and <math>f(x + k)</math> for specific values of <math>k</math> (both positive and negative); find the value of <math>k</math> given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. <i>Include recognizing even and odd functions from their graphs and algebraic expressions for them.</i></p>   |
| <p><a href="#">MAFS.912.F-LE.1.3:</a></p> | <p>Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. ★</p>   |
| <p><a href="#">MAFS.912.S-ID.1.1:</a></p> | <p>Represent data with plots on the real number line (dot plots, histograms, and box plots). ★</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>         In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.</p> </div>  |
| <p><a href="#">MAFS.912.S-ID.1.2:</a></p> | <p>Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. ★</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>         In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.</p> </div> |
| <p><a href="#">MAFS.912.S-ID.1.3:</a></p> | <p>Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). ★</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>         In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.</p> </div>                                     |
| <p><a href="#">MAFS.912.S-ID.1.4:</a></p> | <p>Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to</p>  |

estimate areas under the normal curve. ★

[MAFS.912.S-ID.2.5:](#)

Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. ★

Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. ★

[MAFS.912.S-ID.2.6:](#)

- a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear, and exponential models.*
- b. Informally assess the fit of a function by plotting and analyzing residuals.
- c. Fit a linear function for a scatter plot that suggests a linear association.

**Remarks/Examples:**

Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals.

[MAFS.912.S-ID.3.7:](#)

Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. ★

[MAFS.912.S-ID.3.8:](#)

Compute (using technology) and interpret the correlation coefficient of a linear fit. ★

[MAFS.912.S-ID.3.9:](#)

Distinguish between correlation and causation. ★

[LAFS.910.SL.1.1:](#)

Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

- a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.
- b. Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals

- and deadlines, and individual roles as needed.
- c. Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.
  - d. Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.

[LAFS.910.SL.1.2:](#)

Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.

[LAFS.910.SL.1.3:](#)

Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.

[LAFS.910.SL.2.4:](#)

Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

[LAFS.910.RST.1.3:](#)

Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

[LAFS.910.RST.2.4:](#)

Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.

[LAFS.910.RST.3.7:](#)

Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

[LAFS.910.WHST.1.1:](#)

Write arguments focused on *discipline-specific content*.

- a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.
- b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience’s knowledge level and concerns.
- c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships

|   |   |
|---|---|
|   | <p>between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.</p> <ul style="list-style-type: none"> <li>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.</li> <li>e. Provide a concluding statement or section that follows from or supports the argument presented.</li> </ul>  |
| <p><a href="#">LAFS.910.WHST.2.4:</a></p> | <p>Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.</p>   |
| <p><a href="#">LAFS.910.WHST.3.9:</a></p> | <p>Draw evidence from informational texts to support analysis, reflection, and research.</p>  |
| <p><a href="#">MAFS.K12.MP.1.1:</a></p>   | <p><b>Make sense of problems and persevere in solving them.</b></p> <p>Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.</p> |
| <p><a href="#">MAFS.K12.MP.2.1:</a></p>   | <p><b>Reason abstractly and quantitatively.</b></p> <p>Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their</p>   |

own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

**Construct viable arguments and critique the reasoning of others.**

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

[MAFS.K12.MP.3.1:](#)

**Model with mathematics.**

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a

[MAFS.K12.MP.4.1:](#)

practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

**Use appropriate tools strategically.**

[MAFS.K12.MP.5.1:](#)

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

[MAFS.K12.MP.6.1:](#)

**Attend to precision.**

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

[MAFS.K12.MP.7.1:](#)

**Look for and make use of structure.**

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

**Look for and express regularity in repeated reasoning.**

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

[MAFS.K12.MP.8.1:](#)

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.AC.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.



## Calculus Honors (#1202300)

**Version for Academic Year:** 2015 - 2016

**Course Number:** 1202300

**Abbreviated Title:** CALCULUS HON

**Number of Credits:** One credit (1)

**Course Length:** Year (Y)

**Honors?** Yes

**Course Type:** Core

**Course Level:** 3

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 9,10,11,12

### GENERAL NOTES

#### English Language Development ELD Standards Special Notes Section:

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

### COURSE STANDARDS

| Name                            | Description   |
|---------------------------------|---|
| <a href="#">MAFS.912.C.1.6:</a> | Find limits at infinity.<br><br><b>Remarks/Examples:</b><br><br>Example 1: Find $\lim_{x \rightarrow \infty} \frac{x}{x-1}$ |

Example 2: Find  $\lim_{x \rightarrow \infty} (2x^3 - 500x^2)$

Example 3: Find  $\lim_{x \rightarrow \infty} \frac{x^3 - x + 10}{x^4 - 8}$

Decide when a limit is infinite and use limits involving infinity to describe asymptotic behavior.

[MAFS.912.C.1.7:](#)

**Remarks/Examples:**

Example 1: Find  $\lim_{x \rightarrow 0} \frac{x^2 - 3x}{x^2}$

Example 2: Where does the following function have asymptote(s)? Explain your answer.

$$f(x) = \frac{1}{x^2 - 7x + 10}$$

Find special limits such as  $\lim_{x \rightarrow 0} \frac{\sin x}{x}$

[MAFS.912.C.1.8:](#)

**Remarks/Examples:**

Example: Use a diagram to show that  $\lim_{x \rightarrow 0} \frac{\sin x}{x}$  is equal to 1.

Understand the concept of derivative geometrically, numerically, and analytically, and interpret the derivative as an instantaneous rate of change or as the slope of the tangent line.

[MAFS.912.C.2.1:](#)

**Remarks/Examples:**

Example: Approximate the derivative of  $f(x) = x^2$  at  $x=5$

by calculating values of  $\frac{f(x+h) - f(x)}{h}$  for values of  $h$  that are very close to zero. Use a diagram to explain what you are doing and what the result means.

State, understand, and apply the definition of derivative.

[MAFS.912.C.2.2:](#)

**Remarks/Examples:**

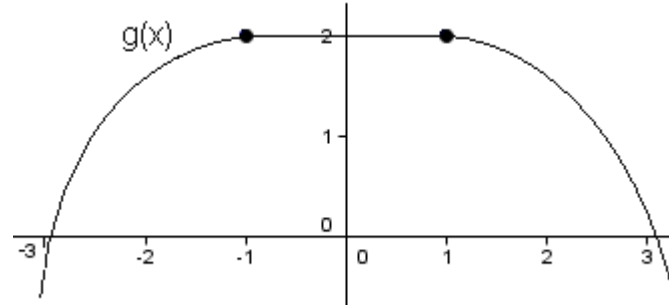
Example 1 (related to the example given in C.2.1): Find

$\lim_{h \rightarrow 0} \frac{(5+h)^2 - 5^2}{h}$ . What does the result tell you?

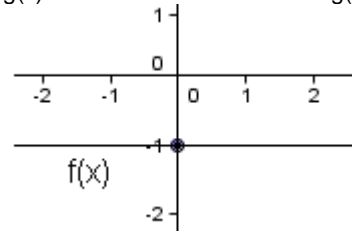
Use the limit given above to determine the derivative function for  $f(x)$ . In

other words calculate  $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$  for  $f(x) = x^2$ .

Example 2: For the function  $g(x)$ , shown on the graph, draw the graph of  $g'(x)$  by estimation. Explain how you arrived at your solution.



Example 3: The graph of the function  $f(x)$  is given below. Find a function  $g(x)$  such that the derivative of  $g(x)$  will be  $f(x)$ . Explain your solution.



Find the derivatives of functions, including algebraic, trigonometric, logarithmic, and exponential functions.

[MAFS.912.C.2.3:](#)

**Remarks/Examples:**

Example 1: Find  $\frac{dy}{dx}$  for the function  $y = x^2$ .

Example 2: Find  $\frac{dy}{dx}$  for the function  $y = \ln(x)$ .

Find the derivatives of sums, products, and quotients.

[MAFS.912.C.2.4:](#)

**Remarks/Examples:**

Example 1: Find the derivative of the function  $f(x) = x \cos(x)$ .

Example 2: Using the quotient rule for derivatives, show that the

derivative of  $f(x) = \tan(x)$  is  $f'(x) = \sec^2(x)$ .

[MAFS.912.C.2.5:](#)

Find the derivatives of composite functions using the Chain Rule.

**Remarks/Examples:**

Example 1: Find  $f'(x)$  for  $f(x) = (x^2 + 1)^2$ .

Example 2: Find  $f'(x)$  for  $f(x) = \sin\left(\frac{1}{x}\right)$ .

Find the derivatives of implicitly-defined functions.

[MAFS.912.C.2.6:](#)

**Remarks/Examples:**

Example: For the equation  $x^2 + y^2 = 5$ , find  $\frac{dy}{dx}$  at the point (2, 3).

Find derivatives of inverse functions.

[MAFS.912.C.2.7:](#)

**Remarks/Examples:**

Example: Let  $f(x) = 2x^3$  and  $g(x) = f^{-1}(x)$  find  $g'(2)$ .

Find second derivatives and derivatives of higher order.

[MAFS.912.C.2.8:](#)

**Remarks/Examples:**

Example: Let  $f(x) = e^{3x}$ . Find  $f''(x)$  and  $f'''(x)$ .

Find derivatives using logarithmic differentiation.

[MAFS.912.C.2.9:](#)

**Remarks/Examples:**

Example 1: Find  $\frac{dy}{dx}$  for the following equation:  $y = \sqrt{x^2 + 1} - 1$ .

Example 2: Find the derivative of  $f(x) = (x^2 + 1)^2$ .

Understand and use the relationship between differentiability and continuity.

[MAFS.912.C.2.10:](#)

**Remarks/Examples:**

Example 1: Let  $f(x) = 1/x$ . Is  $f(x)$  continuous at  $x = 0$ ? Is  $f(x)$  differentiable at  $x = 0$ ? Explain your answers.

Example 2: Is  $f(x) = |x|$  continuous at  $x=0$ ? Is  $f(x)$  differentiable at  $x=0$ ? Explain your answers.

Understand and apply the Mean Value Theorem.

[MAFS.912.C.2.11:](#)

**Remarks/Examples:**

Example 1: Let  $f(x) = \sqrt{x}$ . On the interval  $[1, 9]$ , find the value of  $c$  such that  $\frac{f(9) - f(1)}{9 - 1} = f'(c)$ .

Example 2: At a car race, two cars join the race at the same point at the same time. They finish the race in a tie. Prove that some time during the race, the two cars had exactly the same speed. (Hint: Define  $f(t)$ ,  $g(t)$ , and  $h(t)$ , where  $f(t)$  is the distance that car 1 has traveled at time  $t$ ,  $g(t)$  is the distance that car 2 has travelled at time  $t$ , and  $h(t) = f(t) - g(t)$ .)

Find the slope of a curve at a point, including points at which there are vertical tangent lines and no tangent lines.

[MAFS.912.C.3.1:](#)

**Remarks/Examples:**

Example 1: Find the slope of the line tangent to the graph of the equation  $y = x^3$  at the point  $(2, 8)$ .

Example 2: Find the slope of the line tangent to the graph of the function  $f(x) = \sqrt{1-x}$  at  $x=1$ . Explain your answer.

Example 3: Find the slope of the line tangent to the graph of the function  at  $x=2$ . Explain your answer.

[MAFS.912.C.3.2:](#)

Find an equation for the tangent line to a curve at a point and a local linear approximation.

**Remarks/Examples:**

Example 1: Find an equation of the line tangent to the graph of the equation  at the point  $(2, 8)$ .

Example 2: Use a local linear approximation to estimate the derivative of  at  $x=2$ .

Decide where functions are decreasing and increasing. Understand the relationship between the increasing and decreasing behavior of  $f$  and the sign of  $f'$ .

[MAFS.912.C.3.3:](#)

**Remarks/Examples:**

Example 1: For what values of  $x$ , is the function  decreasing?

Example 2: The weight of a new infant baby during the first two months

can be modeled by the following function:  $w(t) = 0.001t^3 - 0.00001t^4$ ,  $w$  represents weight in pounds, and  $t$  represents time in months. When is the infant gaining weight or losing weight during the first two months? Explain your answer.

[MAFS.912.C.3.4:](#)

Find local and absolute maximum and minimum points.

**Remarks/Examples:**

Example 1: For the graph of the function  $f(x) = x^3 - 3x^2 + 2x$ , find the local maximum and local minimum points of  $f(x)$  on  $[-2, 3]$ .

[MAFS.912.C.3.5:](#)

Find points of inflection of functions. Understand the relationship between the concavity of  $f$  and the sign of  $f''$ . Understand points of inflection as places where concavity changes.

**Remarks/Examples:**

Example: For the graph of the function  $f(x) = x^3 - 3x^2 + 2x$ , find the points of inflection of  $f(x)$  and determine where  $f(x)$  is concave upward and concave downward.

[MAFS.912.C.3.6:](#)

Use first and second derivatives to help sketch graphs. Compare the corresponding characteristics of the graphs of  $f$ ,  $f'$ , and  $f''$ .

**Remarks/Examples:**

Example: Use information from the first and second derivatives to sketch the graph of  $f(x) = x^3 - 3x^2 + 2x$ .

[MAFS.912.C.3.7:](#)

Use implicit differentiation to find the derivative of an inverse function.

**Remarks/Examples:**

Example: Let  $f(x) = 2x^3$  and  $g(x) = f^{-1}(x)$ . Find  $g'(x)$  using implicit differentiation.

[MAFS.912.C.3.8:](#)

Solve optimization problems.

**Remarks/Examples:**

Example 1: You want to enclose a rectangular field with an area of  $1000 \text{ m}^2$ . Find the shortest length of fencing you can

|   |   |
|---|---|
|   | <p>use.</p> <p>Example 2: The sum of the perimeters of an equilateral triangle and a square is 20. Find the dimensions of each that will produce the least area.</p>  |
| <p><a href="#">MAFS.912.C.3.9:</a></p>  | <p>Find average and instantaneous rates of change. Understand the instantaneous rate of change as the limit of the average rate of change. Interpret a derivative as a rate of change in applications, including velocity, speed, and acceleration.</p> <p><b>Remarks/Examples:</b><br/> Example: The vertical distance traveled by an object within the earth's gravitational field (and neglecting air resistance) is given by the equation <math>s(t) = \frac{1}{2}gt^2 + v_0t + x_0</math>, where <math>g</math> is the force on the object due to earth's gravity, <math>v_0</math> is the initial velocity, <math>x_0</math> is the initial height above the ground, <math>t</math> is the time in seconds, and down is the negative vertical direction. Determine the instantaneous speed and the average speed for an object, initially at rest, 3 seconds after it is dropped from a 100m tall cliff. What about 5 seconds after?. Use <math>g = -10 \frac{m}{s^2}</math>.</p> |
| <p><a href="#">MAFS.912.C.3.10:</a></p> | <p>Find the velocity and acceleration of a particle moving in a straight line.</p> <p><b>Remarks/Examples:</b><br/> Example: A bead on a wire moves so that, after <math>t</math> seconds, its distance <math>s</math> cm from the midpoint of the wire is given by <math>s(t) = 10t^3 - 15t^4</math>. Find its maximum velocity and where along the wire this occurs.</p>  |
| <p><a href="#">MAFS.912.C.3.11:</a></p> | <p>Model rates of change, including related rates problems.</p> <p><b>Remarks/Examples:</b><br/> Example: One boat is heading due south at 10 mph. Another boat is heading due west at 15 mph. Both boats are heading toward the same point. If the boats maintain their speeds and directions, they will meet in two hours. Find the rate (in miles per hour) that the distance between them is decreasing exactly one hour before they meet.</p>  |
| <p><a href="#">MAFS.912.C.4.1:</a></p>  | <p>Use rectangle approximations to find approximate values of integrals.</p> <p><b>Remarks/Examples:</b><br/> Example: Find an approximate value for <math>\int_0^3 x^2 dx</math> using 6</p>   |

rectangles of equal width under the graph of  $f(x) = x^2$  between  $x=0$  and  $x=3$ . How did you form your rectangles? Compute this approximation three times using at least three different methods to form the rectangles.

[MAFS.912.C.4.2:](#)

Calculate the values of Riemann Sums over equal subdivisions using left, right, and midpoint evaluation points.

**Remarks/Examples:**

Example 1: Find the value of the Riemann Sum over the interval  $[0, 1]$  using 6 subintervals of equal width for  $f(x) = e^x$  evaluated at the midpoint of each subinterval.

Example 2: Estimate  $\int_0^{\pi} \sin x \, dx$  using a Riemann midpoint sum with 4 subintervals.

[MAFS.912.C.4.3:](#)

Interpret a definite integral as a limit of Riemann sums.

**Remarks/Examples:**

Example: Find the values of the Riemann sums over the interval  $[0, 1]$  using 12 and 24 subintervals of equal width for  $f(x) = e^x$  evaluated at the midpoint of each subinterval. Write an expression for the Riemann sums using  $n$  intervals of equal width. Find the limit of this Riemann Sums as  $n$  goes to infinity.

[MAFS.912.C.4.4:](#)

Interpret a definite integral of the rate of change of a quantity over an interval as the change of the quantity over the interval.

That is,  $\int_a^b f'(x) \, dx = f(b) - f(a)$  (Fundamental Theorem of Calculus).

**Remarks/Examples:**

Example: Explain why

$$\int_4^5 2x \, dx = 5^2 - 4^2$$

[MAFS.912.C.4.5:](#)

Use the Fundamental Theorem of Calculus to evaluate definite and indefinite integrals and to represent particular antiderivatives. Perform analytical and graphical analysis of functions so defined.

**Remarks/Examples:**



Example 1: Using antiderivatives, find

$$\int_0^3 x^2 dx$$

Example 2: Evaluate

$$\int_1^5 e^x dx$$

Example 3: Find

$$\int \sqrt{x} dx$$

Use these properties of definite integrals:

- $\int_a^b [f(x) + g(x)] dx = \int_a^b f(x) dx + \int_a^b g(x) dx$
- $\int_a^b k \cdot f(x) dx = k \int_a^b f(x) dx$
- $\int_a^a f(x) dx = 0$
- $\int_a^b f(x) dx = - \int_b^a f(x) dx$
- $\int_a^b f(x) dx + \int_b^a f(x) dx = \int_a^a f(x) dx$
- If  $f(x) \leq g(x)$  on  $[a, b]$ , then  $\int_a^b f(x) dx \leq \int_a^b g(x) dx$

[MAFS.912.C.4.6:](#)

**Remarks/Examples:**

Example 1: Given  $\int_0^2 f(x) dx = 9$  and  $\int_{-2}^0 f(x) dx = -9$ , find  $\int_{-2}^2 f(x) dx$ ,  $\int_0^2 f(x) dx$ , and  $\int_{-2}^0 f(x) dx$ .

Example 2: Evaluate

$$\int_{-1}^1 x^2 dx$$

[MAFS.912.C.4.7:](#)

Use integration by substitution (or change of variable) to find values of integrals.

**Remarks/Examples:**

Example: Find  $\int_0^1 (2x+1) dx$

[MAFS.912.C.4.8:](#)

Use Riemann Sums, the Trapezoidal Rule, and technology to approximate definite integrals of functions represented algebraically, geometrically, and by tables of values.

**Remarks/Examples:**

Example 1: Use the Trapezoidal Rule with 6 subintervals over  $[0, 3]$  for  $f(x) = x^2$  to approximate the value of  $\int_0^3 x^2 dx$ .

Example 2: Find an approximation to

$$\int_{-3}^0 \sqrt{9-x^2} dx$$

Find specific antiderivatives using initial conditions, including finding velocity functions from acceleration functions, finding position functions from velocity functions, and solving applications related to motion along a line.

[MAFS.912.C.5.1:](#)

**Remarks/Examples:**

Example 1: A bead on a wire moves so that its velocity (in cm/s), after  $t$  seconds, is given by  $v(t) = 3 \cos 3t$ . Given that it starts 2 cm to the left of the midpoint of the wire, find its position after 5 seconds.

Example 2: Carla recorded their car's speed during their trip from school to home. She plotted the data and obtained the following graph. What might the graph for distance versus time look like for their trip to home? Label the axes of your graph and explain why you think it might be a correct representation of the distance versus time for their trip.



Use definite integrals to find the area between a curve and the  $x$ -axis or between two curves.

[MAFS.912.C.5.5:](#)

**Remarks/Examples:**

Example: Find the area bounded by  $y = \sqrt{x}$ ,  $y = 0$ , and  $x = 2$ .

[MAFS.912.C.5.7:](#)

Use definite integrals to find the volume of a solid with known cross-sectional area, including solids of revolution.

**Remarks/Examples:**

Example 1: A cone with its vertex at the origin lies symmetrically along the  $x$ -axis. The base of the cone is at  $x = 5$  and the base radius is 7. Use integration to find the volume of the cone.

Example 2: What is the volume of the solid created when the area between the curves  $f(x) = x$  and  $g(x) = x^2$  for  $0 \leq x \leq 1$  is revolved around the  $y$ -axis?

Apply integration to model, and solve problems in physical, biological, and social sciences.

[MAFS.912.C.5.8:](#)

**Remarks/Examples:**

Example: During an acceleration trial, a test vehicle traveling in a straight line has a velocity given by the equation  $v(t)=\sin t$ , where  $t$  is in seconds and velocity is in feet per second. Find the total distance traveled by the test car during the time interval from 0 seconds to 1.5 seconds.

[LAFS.1112.SL.1.1:](#)

Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

- a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.
- b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.
- c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.
- d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task.

[LAFS.1112.SL.1.2:](#)

Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.

[LAFS.1112.SL.1.3:](#)

Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used.

[LAFS.1112.SL.2.4:](#)

Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and

|                                     |  |
|-------------------------------------|--|
|                                     | style are appropriate to purpose, audience, and a range of formal and informal tasks.  |
| <a href="#">LAFS.1112.RST.1.3:</a>  | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.  |
| <a href="#">LAFS.1112.RST.2.4:</a>  | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.   |
| <a href="#">LAFS.1112.RST.3.7:</a>  | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.  |
| <a href="#">LAFS.1112.WHST.1.1:</a> | <p>Write arguments focused on <i>discipline-specific content</i>.</p> <ol style="list-style-type: none"> <li>a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.</li> <li>b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience’s knowledge level, concerns, values, and possible biases.</li> <li>c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.</li> <li>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.</li> <li>e. Provide a concluding statement or section that follows from or supports the argument presented.</li> </ol> |
| <a href="#">LAFS.1112.WHST.2.4:</a> | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.   |
| <a href="#">LAFS.1112.WHST.3.9:</a> | Draw evidence from informational texts to support analysis, reflection, and research.  |
| <a href="#">MAFS.K12.MP.1.1:</a>    | <b>Make sense of problems and persevere in solving them.</b>   |

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

**Reason abstractly and quantitatively.**

[MAFS.K12.MP.2.1:](#)

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

**Construct viable arguments and critique the reasoning of others.**

[MAFS.K12.MP.3.1:](#)

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their

conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

**Model with mathematics.**

[MAFS.K12.MP.4.1:](#)

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

[MAFS.K12.MP.5.1:](#)

**Use appropriate tools strategically.**

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or

course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

**Attend to precision.**

[MAFS.K12.MP.6.1:](#)

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

**Look for and make use of structure.**

[MAFS.K12.MP.7.1:](#)

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize

that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

**Look for and express regularity in repeated reasoning.**

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

[MAFS.K12.MP.8.1:](#)

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.AC.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.



## **Intensive Mathematics (#1200400)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 1200400

**Abbreviated Title:** INTENS MATH

**Number of Credits:** Multiple Credit (more than 1 credit)

**Course Type:** Elective

**Course Level:** 2

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 9,10,11,12

### **VERSION DESCRIPTION**

For each year in which a student scores at Level 1 on FCAT 2.0 Mathematics, the student must receive remediation by completing an intensive mathematics course the following year or having the remediation integrated into the student's required mathematics course. This course should be tailored to meet the needs of the individual student. Appropriate benchmarks from the following set of standards should be identified to develop an appropriate curriculum.

### **GENERAL NOTES**

#### **English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

### **COURSE STANDARDS**

| <b>Name</b>                        | <b>Description</b>  |
|------------------------------------|---|
| <a href="#">MAFS.912.N-RN.1.1:</a> | Explain how the definition of the meaning of rational exponents |

|                                     |   |
|-------------------------------------|---|
|                                     | follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. <i>For example, we define <math>5^{1/3}</math> to be the cube root of 5 because we want <math>(5^{1/3})^3 = 5^{(1/3)3}</math> to hold, so <math>(5^{1/3})^3</math> must equal 5.</i>   |
| <a href="#">MAFS.912.N-RN.1.2:</a>  | Rewrite expressions involving radicals and rational exponents using the properties of exponents.  |
| <a href="#">MAFS.912.N-RN.2.3:</a>  | Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.   |
| <a href="#">MAFS.912.N-Q.1.1:</a>   | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. ★   |
| <a href="#">MAFS.912.N-Q.1.2:</a>   | Define appropriate quantities for the purpose of descriptive modeling. ★<br><div style="border: 1px solid black; padding: 10px; margin-top: 10px;"> <p><b>Remarks/Examples:</b></p> <p><b>Algebra 1 Content Notes:</b></p> <p>Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions.</p> </div>   |
| <a href="#">MAFS.912.N-Q.1.3:</a>   | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. ★   |
| <a href="#">MAFS.912.A-SSE.1.1:</a> | Interpret expressions that represent a quantity in terms of its context. ★<br><br><ol style="list-style-type: none"> <li>a. Interpret parts of an expression, such as terms, factors, and coefficients.</li> <li>b. Interpret complicated expressions by viewing one or more of their parts as a single entity. <i>For example, interpret <math>P(1+r)^n</math> as the product of <math>P</math> and a factor not depending on <math>P</math>.</i></li> </ol> |
| <a href="#">MAFS.912.A-SSE.1.2:</a> | Use the structure of an expression to identify ways to rewrite it. <i>For example, see <math>x^4 - y^4</math> as <math>(x^2)^2 - (y^2)^2</math>, thus recognizing it as a difference of squares that can be factored as <math>(x^2 - y^2)(x^2 + y^2)</math>.</i>  |
| <a href="#">MAFS.912.A-SSE.2.3:</a> | Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the  |

expression. ★

- a. Factor a quadratic expression to reveal the zeros of the function it defines.
- b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
- c. Use the properties of exponents to transform expressions for exponential functions. *For example the expression  $1.15^t$  can be rewritten as  $(1.15^{1/12})^{12t} \approx 1.012^{12t}$  to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*

[MAFS.912.A-APR.1.1:](#)

Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.

**Remarks/Examples:  
Algebra 1 - Fluency Recommendations**

Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in algebra, as well as in their symbolic work with functions. Manipulation can be more mindful when it is fluent.

[MAFS.912.A-APR.2.3:](#)

Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.

[MAFS.912.A-CED.1.1:](#)

Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational, absolute, and exponential functions. ★

[MAFS.912.A-CED.1.2:](#)

Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. ★

[MAFS.912.A-CED.1.3:](#)

Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.* ★

[MAFS.912.A-CED.1.4:](#)

Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law  $V = IR$  to highlight resistance  $R$ .* ★

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| <a href="#">MAFS.912.A-REI.1.1:</a>  | Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.  |
| <a href="#">MAFS.912.A-REI.2.3:</a>  | Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.   |
| <a href="#">MAFS.912.A-REI.2.4:</a>  | Solve quadratic equations in one variable. <ul style="list-style-type: none"> <li>a. Use the method of completing the square to transform any quadratic equation in <math>x</math> into an equation of the form <math>(x - p)^2 = q</math> that has the same solutions. Derive the quadratic formula from this form.</li> <li>b. Solve quadratic equations by inspection (e.g., for <math>x^2 = 49</math>), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as <math>a \pm bi</math> for real numbers <math>a</math> and <math>b</math>.</li> </ul> |
| <a href="#">MAFS.912.A-REI.3.5:</a>  | Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.  |
| <a href="#">MAFS.912.A-REI.3.6:</a>  | Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.   |
| <a href="#">MAFS.912.A-REI.4.10:</a> | Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).  |
| <a href="#">MAFS.912.A-REI.4.11:</a> | Explain why the $x$ -coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$ ; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. ★   |
| <a href="#">MAFS.912.A-REI.4.12:</a> | Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.  |
| <a href="#">MAFS.912.F-IF.1.1:</a>   | Understand that a function from one set (called the domain) to   |

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|                                    | <p>another set (called the range) assigns to each element of the domain exactly one element of the range. If <math>f</math> is a function and <math>x</math> is an element of its domain, then <math>f(x)</math> denotes the output of <math>f</math> corresponding to the input <math>x</math>. The graph of <math>f</math> is the graph of the equation <math>y = f(x)</math>.</p>   |
| <a href="#">MAFS.912.F-IF.1.2:</a> | <p>Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.</p>   |
| <a href="#">MAFS.912.F-IF.1.3:</a> | <p>Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by <math>f(0) = f(1) = 1</math>, <math>f(n+1) = f(n) + f(n-1)</math> for <math>n \geq 1</math>.</p>   |
| <a href="#">MAFS.912.F-IF.2.4:</a> | <p>For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. <i>Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</i> ★</p>   |
| <a href="#">MAFS.912.F-IF.2.5:</a> | <p>Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. <i>For example, if the function <math>h(n)</math> gives the number of person-hours it takes to assemble engines in a factory, then the positive integers would be an appropriate domain for the function.</i> ★</p>  |
| <a href="#">MAFS.912.F-IF.2.6:</a> | <p>Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. ★</p>  |
| <a href="#">MAFS.912.F-IF.3.8:</a> | <p>Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.</p> <ol style="list-style-type: none"> <li>Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.</li> <li>Use the properties of exponents to interpret expressions for exponential functions. <i>For example, identify percent rate of change in functions such as <math>y = (1.02)^t</math>, <math>y = (0.97)^t</math>, <math>y = (1.01)^{2t}</math>, <math>y = (1.2)^{t/10}</math>, and classify them as representing exponential growth or decay.</i></li> </ol> |

[MAFS.912.F-IF.3.9:](#)

Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*

[MAFS.912.F-BF.1.1:](#)

Write a function that describes a relationship between two quantities. ★

- a. Determine an explicit expression, a recursive process, or steps for calculation from a context.
- b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*
- c. Compose functions. *For example, if  $T(y)$  is the temperature in the atmosphere as a function of height, and  $h(t)$  is the height of a weather balloon as a function of time, then  $T(h(t))$  is the temperature at the location of the weather balloon as a function of time.*

[MAFS.912.F-BF.2.3:](#)

Identify the effect on the graph of replacing  $f(x)$  by  $f(x) + k$ ,  $k f(x)$ ,  $f(kx)$ , and  $f(x + k)$  for specific values of  $k$  (both positive and negative); find the value of  $k$  given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.*

[MAFS.912.F-LE.1.1:](#)

Distinguish between situations that can be modeled with linear functions and with exponential functions. ★

- a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.
- b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
- c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

[MAFS.912.F-LE.1.2:](#)

Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). ★

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| <a href="#">MAFS.912.F-LE.1.3:</a>  | Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. ★  |
| <a href="#">MAFS.912.F-LE.2.5:</a>  | Interpret the parameters in a linear or exponential function in terms of a context. ★   |
| <a href="#">MAFS.912.G-CO.1.1:</a>  | Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.   |
| <a href="#">MAFS.912.G-CO.1.2:</a>  | Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).  |
| <a href="#">MAFS.912.G-CO.1.3:</a>  | Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.  |
| <a href="#">MAFS.912.G-CO.1.4:</a>  | Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.  |
| <a href="#">MAFS.912.G-CO.1.5:</a>  | Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.  |
| <a href="#">MAFS.912.G-CO.2.6:</a>  | Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.  |
| <a href="#">MAFS.912.G-CO.2.7:</a>  | Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.  |
| <a href="#">MAFS.912.G-CO.2.8:</a>  | Explain how the criteria for triangle congruence (ASA, SAS, SSS, and Hypotenuse-Leg) follow from the definition of congruence in terms of rigid motions.  |
| <a href="#">MAFS.912.G-CO.3.9:</a>  | Prove theorems about lines and angles; use theorems about lines and angles to solve problems. <i>Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.</i> |
| <a href="#">MAFS.912.G-CO.3.10:</a> | Prove theorems about triangles; use theorems about triangles to solve problems. <i>Theorems include: measures of interior angles of a triangle sum to <math>180^\circ</math>; triangle inequality theorem; base angles</i>  |

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|                                     | <p><i>of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.</i></p>   |
| <a href="#">MAFS.912.G-CO.3.11:</a> | <p>Prove theorems about parallelograms; use theorems about parallelograms to solve problems. <i>Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.</i></p>   |
| <a href="#">MAFS.912.G-CO.4.12:</a> | <p>Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). <i>Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.</i></p> <div style="border: 1px solid black; padding: 10px; margin: 10px 0;"> <p><b>Remarks/Examples:</b><br/> <b>Geometry - Fluency Recommendations</b></p> <p>Fluency with the use of construction tools, physical and computational, helps students draft a model of a geometric phenomenon and can lead to conjectures and proofs.</p> </div> |
| <a href="#">MAFS.912.G-CO.4.13:</a> | <p>Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.</p>   |
| <a href="#">MAFS.912.G-SRT.1.1:</a> | <p>Verify experimentally the properties of dilations given by a center and a scale factor:</p> <ol style="list-style-type: none"> <li>a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.</li> <li>b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.</li> </ol>   |
| <a href="#">MAFS.912.G-SRT.1.2:</a> | <p>Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.</p>  |
| <a href="#">MAFS.912.G-SRT.1.3:</a> | <p>Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.</p>   |
| <a href="#">MAFS.912.G-SRT.2.4:</a> | <p>Prove theorems about triangles. <i>Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle</i></p>  |



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|  | <p><i>similarity.</i></p> <p>Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.</p>  |
| <p><a href="#">MAFS.912.G-SRT.2.5:</a></p> | <div style="border: 1px solid black; padding: 10px;"> <p><b>Remarks/Examples:</b><br/> <b>Geometry - Fluency Recommendations</b></p> <p>Fluency with the triangle congruence and similarity criteria will help students throughout their investigations of triangles, quadrilaterals, circles, parallelism, and trigonometric ratios. These criteria are necessary tools in many geometric modeling tasks.</p> </div> |
| <p><a href="#">MAFS.912.G-SRT.3.6:</a></p> | <p>Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.</p>   |
| <p><a href="#">MAFS.912.G-SRT.3.7:</a></p> | <p>Explain and use the relationship between the sine and cosine of complementary angles.</p>  |
| <p><a href="#">MAFS.912.G-SRT.3.8:</a></p> | <p>Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. ★</p>   |
| <p><a href="#">MAFS.912.G-C.1.1:</a></p>   | <p>Prove that all circles are similar.</p>  |
| <p><a href="#">MAFS.912.G-C.1.2:</a></p>   | <p>Identify and describe relationships among inscribed angles, radii, and chords. <i>Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.</i></p>   |
| <p><a href="#">MAFS.912.G-C.1.3:</a></p>   | <p>Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.</p>   |
| <p><a href="#">MAFS.912.G-C.2.5:</a></p>   | <p>Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.</p>   |
| <p><a href="#">MAFS.912.G-GPE.1.1:</a></p> | <p>Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.</p>  |
| <p><a href="#">MAFS.912.G-GPE.2.4:</a></p> | <p>Use coordinates to prove simple geometric theorems algebraically. <i>For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point <math>(1, \sqrt{3})</math> lies on the circle centered at the origin and containing the point <math>(0, 2)</math>.</i></p>   |

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|  | <p><b>Remarks/Examples:</b><br/> <b>Geometry - Fluency Recommendations</b></p> <p>Fluency with the use of coordinates to establish geometric results, calculate length and angle, and use geometric representations as a modeling tool are some of the most valuable tools in mathematics and related fields.</p>   |
|  | <p>Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).</p>  |
| <p><a href="#">MAFS.912.G-GPE.2.5:</a></p> | <p><b>Remarks/Examples:</b><br/> <b>Geometry - Fluency Recommendations</b></p> <p>Fluency with the use of coordinates to establish geometric results, calculate length and angle, and use geometric representations as a modeling tool are some of the most valuable tools in mathematics and related fields.</p>   |
| <p><a href="#">MAFS.912.G-GPE.2.6:</a></p> | <p>Find the point on a directed line segment between two given points that partitions the segment in a given ratio.</p>   |
| <p><a href="#">MAFS.912.G-GPE.2.7:</a></p> | <p>Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula. ★</p> <p><b>Remarks/Examples:</b><br/> <b>Geometry - Fluency Recommendations</b></p> <p>Fluency with the use of coordinates to establish geometric results, calculate length and angle, and use geometric representations as a modeling tool are some of the most valuable tools in mathematics and related fields.</p> |
| <p><a href="#">MAFS.912.G-GMD.1.1:</a></p> | <p>Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. <i>Use dissection arguments, Cavalieri's principle, and informal limit arguments.</i></p>   |
| <p><a href="#">MAFS.912.G-GMD.1.3:</a></p> | <p>Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. ★</p>   |
| <p><a href="#">MAFS.912.G-GMD.2.4:</a></p> | <p>Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.</p>  |
| <p><a href="#">MAFS.912.G-MG.1.1:</a></p>  | <p>Use geometric shapes, their measures, and their properties to</p>  |

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|                                    | describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). ★   |
| <a href="#">MAFS.912.G-MG.1.2:</a> | Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). ★  |
| <a href="#">MAFS.912.G-MG.1.3:</a> | Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios). ★   |
| <a href="#">MAFS.912.S-ID.1.1:</a> | <p>Represent data with plots on the real number line (dot plots, histograms, and box plots). ★</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>           In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.</p> </div>  |
| <a href="#">MAFS.912.S-ID.1.2:</a> | <p>Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. ★</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>           In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.</p> </div> |
| <a href="#">MAFS.912.S-ID.1.3:</a> | <p>Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). ★</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>           In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.</p> </div>                                     |
| <a href="#">MAFS.912.S-ID.2.5:</a> | Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. ★  |

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| <p><a href="#">MAFS.912.S-ID.2.6:</a></p> | <p>Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. ★</p> <ol style="list-style-type: none"> <li>Fit a function to the data; use functions fitted to data to solve problems in the context of the data. <i>Use given functions or choose a function suggested by the context. Emphasize linear, and exponential models.</i></li> <li>Informally assess the fit of a function by plotting and analyzing residuals.</li> <li>Fit a linear function for a scatter plot that suggests a linear association.</li> </ol> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>Remarks/Examples:</b><br/> Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals.</p> </div> |
| <p><a href="#">MAFS.912.S-ID.3.7:</a></p> | <p>Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. ★</p>   |
| <p><a href="#">MAFS.912.S-ID.3.8:</a></p> | <p>Compute (using technology) and interpret the correlation coefficient of a linear fit. ★</p>  |
| <p><a href="#">MAFS.912.S-ID.3.9:</a></p> | <p>Distinguish between correlation and causation. ★</p>   |
| <p><a href="#">LAFS.910.RL.1.3:</a></p>   | <p>Analyze how complex characters (e.g., those with multiple or conflicting motivations) develop over the course of a text, interact with other characters, and advance the plot or develop the theme.</p>  |
| <p><a href="#">LAFS.910.RL.2.4:</a></p>   | <p>Determine the meaning of words and phrases as they are used in the text, including figurative and connotative meanings; analyze the cumulative impact of specific word choices on meaning and tone (e.g., how the language evokes a sense of time and place; how it sets a formal or informal tone).</p>   |
| <p><a href="#">LAFS.910.RL.3.7:</a></p>   | <p>Analyze the representation of a subject or a key scene in two different artistic mediums, including what is emphasized or absent in each treatment (e.g., Auden’s “Musée des Beaux Arts” and Breughel’s Landscape with the Fall of Icarus).</p>  |
| <p><a href="#">LAFS.910.SL.1.1:</a></p>   | <p>Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.</p> <ol style="list-style-type: none"> <li>Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation</li> </ol>  |

by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.

- b. Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed.
- c. Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.
- d. Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.

[LAFS.910.SL.1.2:](#)

Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.

[LAFS.910.SL.1.3:](#)

Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.

[LAFS.910.SL.2.4:](#)

Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

Write arguments focused on *discipline-specific content*.

[LAFS.910.WHST.1.1:](#)

- a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.
- b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience's knowledge level and concerns.
- c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.
- d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the

- discipline in which they are writing.
- e. Provide a concluding statement or section that follows from or supports the argument presented.

[LAFS.910.WHST.2.4:](#)

Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

[LAFS.910.WHST.3.9:](#)

Draw evidence from informational texts to support analysis, reflection, and research.

[MAFS.K12.MP.1.1:](#)

**Make sense of problems and persevere in solving them.**

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need.

Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

**Reason abstractly and quantitatively.**

[MAFS.K12.MP.2.1:](#)

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of

creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

**Construct viable arguments and critique the reasoning of others.**

[MAFS.K12.MP.3.1:](#)

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

**Model with mathematics.**

[MAFS.K12.MP.4.1:](#)

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in

the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

**Use appropriate tools strategically.**

[MAFS.K12.MP.5.1:](#)

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

**Attend to precision.**

[MAFS.K12.MP.6.1:](#)

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

**Look for and make use of structure.**

[MAFS.K12.MP.7.1:](#)

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how



many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

**Look for and express regularity in repeated reasoning.**

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

[MAFS.K12.MP.8.1:](#)

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.AC.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.

[MAFS.912.F-IF.3.7a:](#)

a. Graph linear and quadratic functions and show intercepts, maxima, and minima.

[MAFS.912.F-IF.3.7b:](#)

b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

[MAFS.912.F-IF.3.7c:](#)

c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.

[MAFS.912.F-IF.3.7e:](#)

e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.



## Pre-Calculus Honors (#1202340)

**Version for Academic Year:** 2015 - 2016

**Course Number:** 1202340

**Abbreviated Title:** PRE-CALCULUS HON

**Number of Credits:** One credit (1)

**Course Length:** Year (Y)

**Honors?** Yes

**Course Type:** Core

**Course Level:** 3

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 9,10,11,12

### GENERAL NOTES

#### English Language Development ELD Standards Special Notes Section:

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

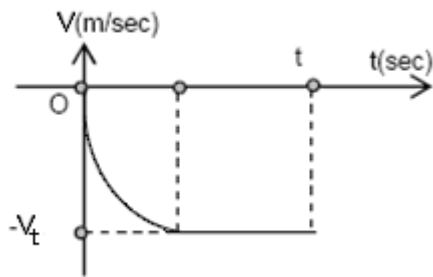
### COURSE STANDARDS

| Name                            | Description   |
|---------------------------------|---|
| <a href="#">MAFS.912.C.1.1:</a> | Understand the concept of limit and estimate limits from graphs and tables of values.<br><br><b>Remarks/Examples:</b><br><br>Example 1: For $f(x) = \frac{x^2 + 2x - 8}{x - 2}$ , |

estimate  $\lim_{x \rightarrow 2} \frac{x^2 + 2x - 8}{x - 2}$  by calculating the function's values for  $x = 2.1, 2.01, 2.001$  and for  $x = 1.9, 1.99, 1.999$ . Explain your answer.

Example 2: A dog started to chase Kathy from 100 meters away. The dog runs fast so that every minute, the distance between Kathy and the dog is halved. Make a graph that shows the distance between Kathy and the dog in meters versus the time in minutes. Write a function to determine the distance between Kathy and the dog at any given time. Will the dog ever catch Kathy? Write a statement about the distance between Kathy and the dog as the time increases.

Example 3: A skydiver free falls from an airplane. The following graph shows the velocity of the skydiver. The air resistance and the gravity are the two forces that affect the velocity of a falling object. Write a paragraph that explains the graph, including but not limited to how the velocity of the skydiver changes as the time increases. You might read about the concept of terminal velocity to make an accurate explanation of the graph.



Find limits by substitution.

**Remarks/Examples:**

Example 1: Find  $\lim_{x \rightarrow 5} (2x + 1)$

Example 2: Find  $\lim_{x \rightarrow 7} (-3x^0)$

Example 3: Find  $\lim_{x \rightarrow 0} \frac{e^{x^2}}{3x - 4}$

[MAFS.912.C.1.2:](#)

Find limits of sums, differences, products, and quotients.

**Remarks/Examples:**

Example: Find  $\lim_{x \rightarrow \pi} (\sin x \cos x + \tan x)$

[MAFS.912.C.1.3:](#)

[MAFS.912.C.1.4:](#)

Find limits of rational functions that are undefined at a point.

**Remarks/Examples:**

Example 1: Find  $\lim_{x \rightarrow 2} \frac{x^2 + 2x - 8}{x - 2}$

Example 2: The magnitude of the force between two positive charges,  $q_1$

and  $q_2$  can be described by the following function:  

$$F(r) = k \frac{q_1 q_2}{r^2}$$
 where  $k$  is a constant, called Coulomb's constant, and  $r$  is the distance

between the two charges. Find  $\lim_{r \rightarrow 0} F(r)$ . Interpret the answer in the context of the force between the two charges.

Find one-sided limits.

[MAFS.912.C.1.5:](#)

**Remarks/Examples:**

Example 1: Find

$$\lim_{x \rightarrow 4^+} -\sqrt{4-x}$$

Example 2: Find

$$\lim_{x \rightarrow 1^-} \frac{x^2 - 3x + 2}{|x-1|}$$

Understand continuity in terms of limits.

[MAFS.912.C.1.9:](#)

**Remarks/Examples:**

Example 1: Show that  $f(x) = 3x + 1$  is continuous at  $x = 2$  by

finding  $\lim_{x \rightarrow 2} (3x + 1)$  and comparing it with  $f(2)$ .

Example 2: Given that the  $\lim_{x \rightarrow 5} g(x)$  as  $x$  approaches to 5 exists, is the statement " $g(x)$  is continuous at  $x=5$ " necessarily true? Provide example functions to support your conclusion.

Decide if a function is continuous at a point.

[MAFS.912.C.1.10:](#)

**Remarks/Examples:**


Example: Determine if the function  $f(x) = \frac{x^2 + 2x - 3}{x - 1}$  can be made continuous by defining the function with a specific value at  $x=2$ .

Find the types of discontinuities of a function.

[MAFS.912.C.1.11:](#)

**Remarks/Examples:**

Example: Suppose  $h(x) = \frac{x^2 - 3x + 6}{x^2 - 1}$ . Identify and categorize any discontinuities in  $h(x)$ . Explain your answer.

|   |   |
|---|---|
| <p><a href="#">MAFS.912.C.1.12:</a></p>   | <p>Understand and use the Intermediate Value Theorem on a function over a closed interval.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/> Example 1: Use the Intermediate Value Theorem to show that  has a zero between <math>x = 0</math> and <math>x = 3</math>.</p> </div>  |
| <p><a href="#">MAFS.912.C.1.13:</a></p>   | <p>Understand and apply the Extreme Value Theorem: If <math>f(x)</math> is continuous over a closed interval, then <math>f</math> has a maximum and a minimum on the interval.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/> Example: Use the Extreme Value Theorem to decide whether <math>f(x)=\tan(x)</math> has a minimum and maximum on the interval <math>[-\frac{\pi}{4}, \frac{\pi}{4}]</math>. What about on the interval <math>[-\pi, \pi]</math>? Explain your reasoning.</p> </div> |
| <p><a href="#">MAFS.912.N-CN.1.3:</a></p> | <p>Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.</p>  |
| <p><a href="#">MAFS.912.N-CN.2.4:</a></p> | <p>Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number.</p>  |
| <p><a href="#">MAFS.912.N-CN.2.5:</a></p> | <p>Represent addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the complex plane; use properties of this representation for computation. For example, <math>(-1 + \sqrt{3} i)^3 = 8</math> because <math>(-1 + \sqrt{3} i)</math> has modulus 2 and argument <math>120^\circ</math>.</p>   |
| <p><a href="#">MAFS.912.N-CN.3.9:</a></p> | <p>Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.</p>   |
| <p><a href="#">MAFS.912.N-VM.1.1:</a></p> | <p>Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., <math>\mathbf{v}</math>, <math>v</math>, <math>\ \mathbf{v}\ </math>, <math>v</math>).</p>  |
| <p><a href="#">MAFS.912.N-VM.1.2:</a></p> | <p>Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.</p>   |
| <p><a href="#">MAFS.912.N-VM.1.3:</a></p> | <p>Solve problems involving velocity and other quantities that can be represented by vectors.</p>   |
| <p><a href="#">MAFS.912.N-VM.2.4:</a></p> | <p>Add and subtract vectors.</p> <ol style="list-style-type: none"> <li>a. Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the</li> </ol>  |

|  |  |
|--|--|
|  | <p>magnitudes.</p> <p>b. Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum.</p> <p>c. Understand vector subtraction <math>\mathbf{v} - \mathbf{w}</math> as <math>\mathbf{v} + (-\mathbf{w})</math>, where <math>-\mathbf{w}</math> is the additive inverse of <math>\mathbf{w}</math>, with the same magnitude as <math>\mathbf{w}</math> and pointing in the opposite direction. Represent vector subtraction graphically by connecting the tips in the appropriate order, and perform vector subtraction component-wise.</p>  |
| <p><a href="#">MAFS.912.N-VM.2.5:</a></p>  | <p>Multiply a vector by a scalar.</p> <p>a. Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise, e.g., as <math>c \begin{pmatrix} v_x \\ v_y \end{pmatrix} = \begin{pmatrix} cv_x \\ cv_y \end{pmatrix}</math>.</p> <p>b. Compute the magnitude of a scalar multiple <math>c\mathbf{v}</math> using <math>\ c\mathbf{v}\  =  c v</math>. Compute the direction of <math>c\mathbf{v}</math> knowing that when <math> c v \neq 0</math>, the direction of <math>c\mathbf{v}</math> is either along <math>\mathbf{v}</math> (for <math>c &gt; 0</math>) or against <math>\mathbf{v}</math> (for <math>c &lt; 0</math>).</p> |
| <p><a href="#">MAFS.912.A-APR.3.4:</a></p> | <p>Prove polynomial identities and use them to describe numerical relationships. For example, the polynomial identity <math>(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2</math> can be used to generate Pythagorean triples.</p>  |
| <p><a href="#">MAFS.912.A-APR.3.5:</a></p> | <p>Know and apply the Binomial Theorem for the expansion of <math>(x + y)^n</math> in powers of <math>x</math> and <math>y</math> for a positive integer <math>n</math>, where <math>x</math> and <math>y</math> are any numbers, with coefficients determined for example by Pascal's Triangle.</p>   |
| <p><a href="#">MAFS.912.A-APR.4.6:</a></p> | <p>Rewrite simple rational expressions in different forms; write <math>a(x)/b(x)</math> in the form <math>q(x) + r(x)/b(x)</math>, where <math>a(x)</math>, <math>b(x)</math>, <math>q(x)</math>, and <math>r(x)</math> are polynomials with the degree of <math>r(x)</math> less than the degree of <math>b(x)</math>, using inspection, long division, or, for the more complicated examples, a computer algebra system.</p>   |
| <p><a href="#">MAFS.912.A-APR.4.7:</a></p> | <p>Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.</p>  |
| <p><a href="#">MAFS.912.F-BF.1.1:</a></p>  | <p>Write a function that describes a relationship between two quantities. ★</p> <p>a. Determine an explicit expression, a recursive process, or steps for calculation from a context.</p>  |

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|                                    | <p>b. Combine standard function types using arithmetic operations. <i>For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.</i></p> <p>c. Compose functions. <i>For example, if <math>T(y)</math> is the temperature in the atmosphere as a function of height, and <math>h(t)</math> is the height of a weather balloon as a function of time, then <math>T(h(t))</math> is the temperature at the location of the weather balloon as a function of time.</i></p>              |
|                                    | <p>Find inverse functions.</p> <p>a. Solve an equation of the form <math>f(x) = c</math> for a simple function <math>f</math> that has an inverse and write an expression for the inverse. <i>For example, <math>f(x) = 2x^3</math> or <math>f(x) = (x+1)/(x-1)</math> for <math>x \neq 1</math>.</i></p> <p>b. Verify by composition that one function is the inverse of another.</p> <p>c. Read values of an inverse function from a graph or a table, given that the function has an inverse.</p> <p>d. Produce an invertible function from a non-invertible function by restricting the domain.</p> |
| <a href="#">MAFS.912.F-BF.2.4:</a> |   |
| <a href="#">MAFS.912.F-TF.1.1:</a> | Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle; Convert between degrees and radians.  |
| <a href="#">MAFS.912.F-TF.1.2:</a> | Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.   |
| <a href="#">MAFS.912.F-TF.1.3:</a> | Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$ , $\pi/4$ and $\pi/6$ , and use the unit circle to express the values of sine, cosine, and tangent for $\pi-x$ , $\pi+x$ , and $2\pi-x$ in terms of their values for $x$ , where $x$ is any real number.   |
| <a href="#">MAFS.912.F-TF.1.4:</a> | Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.  |
| <a href="#">MAFS.912.F-TF.2.5:</a> | Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline. ★  |
| <a href="#">MAFS.912.F-TF.2.6:</a> | Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.  |
| <a href="#">MAFS.912.F-TF.2.7:</a> | Use inverse functions to solve trigonometric equations that arise   |



|                                      |   |
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|                                      | in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context. ★  |
| <a href="#">MAFS.912.F-TF.3.8:</a>   | Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to calculate trigonometric ratios.  |
| <a href="#">MAFS.912.F-TF.3.9:</a>   | Prove the addition and subtraction, half-angle, and double-angle formulas for sine, cosine, and tangent and use these formulas to solve problems.   |
| <a href="#">MAFS.912.G-SRT.3.8:</a>  | Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. ★  |
| <a href="#">MAFS.912.G-SRT.4.9:</a>  | Derive the formula $A = 1/2 ab \sin(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.   |
| <a href="#">MAFS.912.G-SRT.4.10:</a> | Prove the Laws of Sines and Cosines and use them to solve problems.   |
| <a href="#">MAFS.912.G-SRT.4.11:</a> | Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).  |
| <a href="#">MAFS.912.G-GPE.1.1:</a>  | Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.   |
| <a href="#">MAFS.912.G-GPE.1.2:</a>  | Derive the equation of a parabola given a focus and directrix.  |
| <a href="#">MAFS.912.G-GPE.1.3:</a>  | Derive the equations of ellipses and hyperbolas given the foci and directrices.   |
| <a href="#">LAFS.1112.SL.1.1:</a>    | <p>Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.</p> <ol style="list-style-type: none"> <li>Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.</li> <li>Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.</li> <li>Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.</li> <li>Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and</li> </ol> |

|                                     |   |
|-------------------------------------|---|
|                                     | determine what additional information or research is required to deepen the investigation or complete the task.   |
| <a href="#">LAFS.1112.SL.1.2:</a>   | Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.   |
| <a href="#">LAFS.1112.SL.1.3:</a>   | Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used.   |
| <a href="#">LAFS.1112.SL.2.4:</a>   | Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.   |
| <a href="#">LAFS.1112.RST.1.3:</a>  | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.   |
| <a href="#">LAFS.1112.RST.2.4:</a>  | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.  |
| <a href="#">LAFS.1112.RST.3.7:</a>  | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.   |
| <a href="#">LAFS.1112.WHST.1.1:</a> | <p>Write arguments focused on <i>discipline-specific content</i>.</p> <ol style="list-style-type: none"> <li>a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.</li> <li>b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.</li> <li>c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons,</li> </ol> |

between reasons and evidence, and between claim(s) and counterclaims.

- d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
- e. Provide a concluding statement or section that follows from or supports the argument presented.

[LAFS.1112.WHST.2.4:](#)

Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

[LAFS.1112.WHST.3.9:](#)

Draw evidence from informational texts to support analysis, reflection, and research.

[MAFS.K12.MP.1.1:](#)

**Make sense of problems and persevere in solving them.**

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

[MAFS.K12.MP.2.1:](#)

**Reason abstractly and quantitatively.**

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and

manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

**Construct viable arguments and critique the reasoning of others.**

[MAFS.K12.MP.3.1:](#)

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

**Model with mathematics.**

[MAFS.K12.MP.4.1:](#)

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that

these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

[MAFS.K12.MP.5.1:](#)

**Use appropriate tools strategically.**

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

[MAFS.K12.MP.6.1:](#)

**Attend to precision.**

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

**Look for and make use of structure.**

[MAFS.K12.MP.7.1:](#)

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

**Look for and express regularity in repeated reasoning.**

[MAFS.K12.MP.8.1:](#)

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.AC.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.

## Liberal Arts Mathematics 2 (#1207310)

**Version for Academic Year:** 2015 - 2016

**Course Number:** 1207310

**Abbreviated Title:** LIB ARTS MATH 2

**Number of Credits:** One credit (1)

**Course Length:** Year (Y)

**Course Type:** Core

**Course Level:** 2

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 9,10,11,12

**Graduation Requirement:** Mathematics

### GENERAL NOTES

#### English Language Development ELD Standards Special Notes Section:

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

### COURSE STANDARDS

| Name                               | Description   |
|------------------------------------|---|
| <a href="#">MAFS.912.N-RN.1.1:</a> | Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. <i>For example, we define <math>5^{1/3}</math> to be the cube root of 5 because we want <math>(5^{1/3})^3 = 5^{(1/3)3}</math> to hold, so <math>(5^{1/3})^3</math> must equal 5.</i> |

|                                     |  |
|-------------------------------------|--|
| <a href="#">MAFS.912.N-RN.1.2:</a>  | Rewrite expressions involving radicals and rational exponents using the properties of exponents.   |
| <a href="#">MAFS.912.N-RN.2.3:</a>  | Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.  |
| <a href="#">MAFS.912.N-CN.1.1:</a>  | Know there is a complex number $i$ such that $i^2 = -1$ , and every complex number has the form $a + bi$ with $a$ and $b$ real.  |
| <a href="#">MAFS.912.N-CN.1.2:</a>  | Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.  |
| <a href="#">MAFS.912.N-CN.3.7:</a>  | Solve quadratic equations with real coefficients that have complex solutions.  |
| <a href="#">MAFS.912.A-SSE.1.2:</a> | Use the structure of an expression to identify ways to rewrite it. <i>For example, see <math>x^4 - y^4</math> as <math>(x^2)^2 - (y^2)^2</math>, thus recognizing it as a difference of squares that can be factored as <math>(x^2 - y^2)(x^2 + y^2)</math>.</i>   |
| <a href="#">MAFS.912.A-SSE.2.3:</a> | Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. ★<br><br><ul style="list-style-type: none"> <li>a. Factor a quadratic expression to reveal the zeros of the function it defines.</li> <li>b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.</li> <li>c. Use the properties of exponents to transform expressions for exponential functions. <i>For example the expression <math>1.15</math> can be rewritten as <math>(1.15^{1/12})^{12} \approx 1.012^{12}</math> to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.</i></li> </ul> |
| <a href="#">MAFS.912.A-SSE.2.4:</a> | Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. <i>For example, calculate mortgage payments.</i> ★  |
| <a href="#">MAFS.912.A-APR.2.2:</a> | Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number $a$ , the remainder on division by $x - a$ is $p(a)$ , so $p(a) = 0$ if and only if $(x - a)$ is a factor of $p(x)$ .   |
| <a href="#">MAFS.912.A-APR.2.3:</a> | Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.  |
| <a href="#">MAFS.912.A-APR.3.4:</a> | Prove polynomial identities and use them to describe numerical relationships. For example, the polynomial identity $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ .   |



|  |   |
|--|---|
| <p><a href="#">MAFS.912.A-APR.4.6:</a></p> | <p><math>-y^2 + (2xy)^2</math> can be used to generate Pythagorean triples.</p> <p>Rewrite simple rational expressions in different forms; write <math>a(x)/b(x)</math> in the form <math>q(x) + r(x)/b(x)</math>, where <math>a(x)</math>, <math>b(x)</math>, <math>q(x)</math>, and <math>r(x)</math> are polynomials with the degree of <math>r(x)</math> less than the degree of <math>b(x)</math>, using inspection, long division, or, for the more complicated examples, a computer algebra system.</p>  |
| <p><a href="#">MAFS.912.A-REI.2.4:</a></p> | <p>Solve quadratic equations in one variable.</p> <ol style="list-style-type: none"> <li>Use the method of completing the square to transform any quadratic equation in <math>x</math> into an equation of the form <math>(x - p)^2 = q</math> that has the same solutions. Derive the quadratic formula from this form.</li> <li>Solve quadratic equations by inspection (e.g., for <math>x^2 = 49</math>), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as <math>a \pm bi</math> for real numbers <math>a</math> and <math>b</math>.</li> </ol>   |
| <p><a href="#">MAFS.912.A-REI.3.7:</a></p> | <p>Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. <i>For example, find the points of intersection between the line <math>y = -3x</math> and the circle <math>x^2 + y^2 = 3</math>.</i></p>  |
| <p><a href="#">MAFS.912.F-IF.3.7:</a></p>  | <p>Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★</p> <ol style="list-style-type: none"> <li>Graph linear and quadratic functions and show intercepts, maxima, and minima.</li> <li>Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.</li> <li>Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.</li> <li>Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.</li> <li>Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.</li> </ol> |
| <p><a href="#">MAFS.912.F-IF.3.8:</a></p>  | <p>Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the</p>  |

function.

- a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
- b. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent*

*rate of change in functions such as  $y = (1.02)^t$ ,  $y = (0.97)^t$ ,  $y = (1.01)^{2t}$ ,  $y = (1.2)^{t/10}$ , and classify them as representing exponential growth or decay.*

[MAFS.912.F-IF.3.9:](#)

Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*

[MAFS.912.F-LE.1.1:](#)

Distinguish between situations that can be modeled with linear functions and with exponential functions. ★

- a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.
- b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
- c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

[MAFS.912.F-LE.1.2:](#)

Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). ★

[MAFS.912.F-LE.1.3:](#)

Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. ★

[MAFS.912.F-LE.1.4:](#)

For exponential models, express as a logarithm the solution to  $ab^{ct} = d$  where  $a$ ,  $c$ , and  $d$  are numbers and the base  $b$  is 2, 10, or  $e$ ; evaluate the logarithm using technology. ★

[MAFS.912.F-LE.2.5:](#)

Interpret the parameters in a linear or exponential function in

|                                     |   |
|-------------------------------------|---|
|                                     | terms of a context. ★   |
| <a href="#">MAFS.912.G-GPE.1.1:</a> | Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.   |
| <a href="#">MAFS.912.G-GPE.1.2:</a> | Derive the equation of a parabola given a focus and directrix.  |
| <a href="#">MAFS.912.G-GPE.2.4:</a> | <p>Use coordinates to prove simple geometric theorems algebraically. <i>For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point <math>(1, \sqrt{3})</math> lies on the circle centered at the origin and containing the point <math>(0, 2)</math>.</i></p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/> <b>Geometry - Fluency Recommendations</b></p> <p>Fluency with the use of coordinates to establish geometric results, calculate length and angle, and use geometric representations as a modeling tool are some of the most valuable tools in mathematics and related fields.</p> </div> |
| <a href="#">MAFS.912.G-GPE.2.5:</a> | <p>Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/> <b>Geometry - Fluency Recommendations</b></p> <p>Fluency with the use of coordinates to establish geometric results, calculate length and angle, and use geometric representations as a modeling tool are some of the most valuable tools in mathematics and related fields.</p> </div>  |
| <a href="#">MAFS.912.S-IC.1.1:</a>  | Understand statistics as a process for making inferences about population parameters based on a random sample from that population. ★   |
| <a href="#">MAFS.912.S-IC.1.2:</a>  | Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. <i>For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?</i>  |
| <a href="#">MAFS.912.S-IC.2.3:</a>  | Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how   |

|                                    |  |
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|                                    | randomization relates to each. ★   |
| <a href="#">MAFS.912.S-IC.2.4:</a> | Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling. ★   |
| <a href="#">MAFS.912.S-IC.2.5:</a> | Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. ★  |
| <a href="#">MAFS.912.S-IC.2.6:</a> | Evaluate reports based on data. ★  |
| <a href="#">MAFS.912.S-CP.1.4:</a> | Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. <i>For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.</i> ★  |
| <a href="#">MAFS.912.S-CP.1.5:</a> | Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. <i>For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.</i> ★   |
| <a href="#">LAFS.910.SL.1.1:</a>   | <p>Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.</p> <ol style="list-style-type: none"> <li>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.</li> <li>b. Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed.</li> <li>c. Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.</li> <li>d. Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when</li> </ol> |

|                                    |  |
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|                                    | warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.   |
| <a href="#">LAFS.910.SL.1.2:</a>   | Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.   |
| <a href="#">LAFS.910.SL.1.3:</a>   | Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.  |
| <a href="#">LAFS.910.SL.2.4:</a>   | Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.  |
| <a href="#">LAFS.910.RST.1.3:</a>  | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.  |
| <a href="#">LAFS.910.RST.2.4:</a>  | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.  |
| <a href="#">LAFS.910.RST.3.7:</a>  | Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.   |
| <a href="#">LAFS.910.WHST.1.1:</a> | <p>Write arguments focused on <i>discipline-specific content</i>.</p> <ol style="list-style-type: none"> <li>Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.</li> <li>Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience’s knowledge level and concerns.</li> <li>Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.</li> <li>Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.</li> <li>Provide a concluding statement or section that follows from or supports the argument presented.</li> </ol> |

[LAFS.910.WHST.2.4:](#)

Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

[LAFS.910.WHST.3.9:](#)

Draw evidence from informational texts to support analysis, reflection, and research.

[MAFS.K12.MP.1.1:](#)

**Make sense of problems and persevere in solving them.**

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need.

Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

[MAFS.K12.MP.2.1:](#)

**Reason abstractly and quantitatively.**

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

**Construct viable arguments and critique the reasoning of others.**

[MAFS.K12.MP.3.1:](#)

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

**Model with mathematics.**

[MAFS.K12.MP.4.1:](#)

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another.

Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

[MAFS.K12.MP.5.1:](#)

**Use appropriate tools strategically.**

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

**Attend to precision.**

[MAFS.K12.MP.6.1:](#)

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

[MAFS.K12.MP.7.1:](#)

**Look for and make use of structure.**

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure



and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

**Look for and express regularity in repeated reasoning.**

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through  $(1, 2)$  with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

[MAFS.K12.MP.8.1:](#)

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.AC.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.

## Mathematical Analysis Honors (#1201300)

**Version for Academic Year:** 2015 - 2016

**Course Number:** 1201300

**Abbreviated Title:** MATH ANALYSIS HON

**Course Length:** Semester (S)

**Honors?** Yes

**Course Type:** Core

**Course Level:** 3

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 9,10,11,12

### GENERAL NOTES

#### English Language Development ELD Standards Special Notes Section:

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

### COURSE STANDARDS

| Name                               | Description  |
|------------------------------------|--|
| <a href="#">MAFS.912.N-CN.3.9:</a> | Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.                           |
| <a href="#">MAFS.912.N-VM.3.6:</a> | Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network. |
| <a href="#">MAFS.912.N-VM.3.7:</a> | Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled.      |
| <a href="#">MAFS.912.N-VM.3.8:</a> | Add, subtract, and multiply matrices of appropriate dimensions.  |
| <a href="#">MAFS.912.N-VM.3.9:</a> | Understand that, unlike multiplication of numbers, matrix  |

|                                     |  |
|-------------------------------------|--|
|                                     | <p>multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties.</p>   |
| <a href="#">MAFS.912.N-VM.3.10:</a> | <p>Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse.</p>  |
| <a href="#">MAFS.912.N-VM.3.12:</a> | <p>Work with <math>2 \times 2</math> matrices as transformations of the plane, and interpret the absolute value of the determinant in terms of area.</p>   |
| <a href="#">MAFS.912.A-APR.2.2:</a> | <p>Know and apply the Remainder Theorem: For a polynomial <math>p(x)</math> and a number <math>a</math>, the remainder on division by <math>x - a</math> is <math>p(a)</math>, so <math>p(a) = 0</math> if and only if <math>(x - a)</math> is a factor of <math>p(x)</math>.</p>  |
| <a href="#">MAFS.912.A-APR.2.3:</a> | <p>Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.</p>   |
| <a href="#">MAFS.912.A-APR.3.4:</a> | <p>Prove polynomial identities and use them to describe numerical relationships. For example, the polynomial identity <math>(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2</math> can be used to generate Pythagorean triples.</p>  |
| <a href="#">MAFS.912.A-APR.3.5:</a> | <p>Know and apply the Binomial Theorem for the expansion of <math>(x + y)^n</math> in powers of <math>x</math> and <math>y</math> for a positive integer <math>n</math>, where <math>x</math> and <math>y</math> are any numbers, with coefficients determined for example by Pascal's Triangle.</p>   |
| <a href="#">MAFS.912.A-APR.4.6:</a> | <p>Rewrite simple rational expressions in different forms; write <math>a(x)/b(x)</math> in the form <math>q(x) + r(x)/b(x)</math>, where <math>a(x)</math>, <math>b(x)</math>, <math>q(x)</math>, and <math>r(x)</math> are polynomials with the degree of <math>r(x)</math> less than the degree of <math>b(x)</math>, using inspection, long division, or, for the more complicated examples, a computer algebra system.</p> |
| <a href="#">MAFS.912.A-APR.4.7:</a> | <p>Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.</p>  |
| <a href="#">MAFS.912.A-REL.3.8:</a> | <p>Represent a system of linear equations as a single matrix equation in a vector variable.</p>  |
| <a href="#">MAFS.912.A-REL.3.9:</a> | <p>Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension <math>3 \times 3</math> or greater).</p>  |
| <a href="#">MAFS.912.F-IF.3.7:</a>  | <p>Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★</p> <p>a. Graph linear and quadratic functions and show intercepts, maxima, and minima.</p>   |

|   |   |
|---|---|
|   | <ul style="list-style-type: none"> <li>b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.</li> <li>c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.</li> <li>d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.</li> <li>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.</li> </ul>   |
| <p><a href="#">MAFS.912.F-BF.1.1:</a></p> | <p>Write a function that describes a relationship between two quantities. ★</p> <ul style="list-style-type: none"> <li>a. Determine an explicit expression, a recursive process, or steps for calculation from a context.</li> <li>b. Combine standard function types using arithmetic operations. <i>For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.</i></li> <li>c. Compose functions. <i>For example, if <math>T(y)</math> is the temperature in the atmosphere as a function of height, and <math>h(t)</math> is the height of a weather balloon as a function of time, then <math>T(h(t))</math> is the temperature at the location of the weather balloon as a function of time.</i></li> </ul> |
| <p><a href="#">MAFS.912.F-BF.1.2:</a></p> | <p>Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. ★</p>   |
| <p><a href="#">MAFS.912.F-BF.2.3:</a></p> | <p>Identify the effect on the graph of replacing <math>f(x)</math> by <math>f(x) + k</math>, <math>k f(x)</math>, <math>f(kx)</math>, and <math>f(x + k)</math> for specific values of <math>k</math> (both positive and negative); find the value of <math>k</math> given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. <i>Include recognizing even and odd functions from their graphs and algebraic expressions for them.</i></p>  |
| <p><a href="#">MAFS.912.S-CP.2.8:</a></p> | <p>Apply the general Multiplication Rule in a uniform probability model, <math>P(A \text{ and } B) = P(A)P(B A) = P(B)P(A B)</math>, and interpret the answer in terms of the model. ★</p>  |
| <p><a href="#">MAFS.912.S-CP.2.9:</a></p> | <p>Use permutations and combinations to compute probabilities of compound events and solve problems. ★</p>  |

|                                     |  |
|-------------------------------------|--|
| <a href="#">LAFS.1112.RST.1.3:</a>  | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.  |
| <a href="#">LAFS.1112.RST.2.4:</a>  | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.   |
| <a href="#">LAFS.1112.RST.3.7:</a>  | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.  |
| <a href="#">LAFS.1112.WHST.1.1:</a> | <p>Write arguments focused on <i>discipline-specific content</i>.</p> <ol style="list-style-type: none"> <li>a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.</li> <li>b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience’s knowledge level, concerns, values, and possible biases.</li> <li>c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.</li> <li>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.</li> <li>e. Provide a concluding statement or section that follows from or supports the argument presented.</li> </ol> |
| <a href="#">LAFS.1112.WHST.2.4:</a> | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.   |
| <a href="#">LAFS.1112.WHST.3.9:</a> | Draw evidence from informational texts to support analysis, reflection, and research.  |
| <a href="#">MAFS.K12.MP.1.1:</a>    | <p><b>Make sense of problems and persevere in solving them.</b></p> <p>Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry</p>   |

points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

**Reason abstractly and quantitatively.**

[MAFS.K12.MP.2.1:](#)

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

[MAFS.K12.MP.3.1:](#)

**Construct viable arguments and critique the reasoning of others.**

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They

justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

**Model with mathematics.**

[MAFS.K12.MP.4.1:](#)

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

[MAFS.K12.MP.5.1:](#)

**Use appropriate tools strategically.**

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and

their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

**Attend to precision.**

[MAFS.K12.MP.6.1:](#)

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

**Look for and make use of structure.**

[MAFS.K12.MP.7.1:](#)

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .



**Look for and express regularity in repeated reasoning.**

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

[MAFS.K12.MP.8.1:](#)

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.AC.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.

## Probability & Statistics with Applications Honors (#1210300)

**Version for Academic Year:** 2015 - 2016

**Course Number:** 1210300

**Abbreviated Title:** PROB, STAT W/APPLS H

**Number of Credits:** One credit (1)

**Course Length:** Year (Y)

**Honors?** Yes

**Course Type:** Core

**Course Level:** 3

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 9,10,11,12

### GENERAL NOTES

#### English Language Development ELD Standards Special Notes Section:

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

### COURSE STANDARDS

| Name                               | Description   |
|------------------------------------|---|
| <a href="#">MAFS.912.S-ID.1.1:</a> | Represent data with plots on the real number line (dot plots, histograms, and box plots). ★<br><br><b>Remarks/Examples:</b><br>In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, |

such as the shape of the distribution or the existence of extreme data points.

[MAFS.912.S-ID.1.2:](#)

Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. ★

**Remarks/Examples:**

In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.

[MAFS.912.S-ID.1.3:](#)

Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). ★

**Remarks/Examples:**

In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.

[MAFS.912.S-ID.1.4:](#)

Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. ★

[MAFS.912.S-ID.2.5:](#)

Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. ★

[MAFS.912.S-ID.2.6:](#)

Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. ★

- a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear, and exponential models.*
- b. Informally assess the fit of a function by plotting and analyzing residuals.
- c. Fit a linear function for a scatter plot that suggests a

|                                    |  |
|------------------------------------|--|
|                                    | linear association.  |
|                                    | <p><b>Remarks/Examples:</b><br/> Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals.</p>      |
| <a href="#">MAFS.912.S-ID.3.7:</a> | Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. ★   |
| <a href="#">MAFS.912.S-ID.3.8:</a> | Compute (using technology) and interpret the correlation coefficient of a linear fit. ★  |
| <a href="#">MAFS.912.S-ID.3.9:</a> | Distinguish between correlation and causation. ★   |
| <a href="#">MAFS.912.S-IC.1.1:</a> | Understand statistics as a process for making inferences about population parameters based on a random sample from that population. ★  |
| <a href="#">MAFS.912.S-IC.1.2:</a> | Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. <i>For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?</i> |
| <a href="#">MAFS.912.S-IC.2.3:</a> | Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. ★   |
| <a href="#">MAFS.912.S-IC.2.4:</a> | Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling. ★   |
| <a href="#">MAFS.912.S-IC.2.5:</a> | Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. ★  |
| <a href="#">MAFS.912.S-IC.2.6:</a> | Evaluate reports based on data. ★  |
| <a href="#">MAFS.912.S-CP.1.1:</a> | Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”). ★  |
| <a href="#">MAFS.912.S-CP.1.2:</a> | Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent. ★   |
| <a href="#">MAFS.912.S-CP.1.3:</a> | Understand the conditional probability of A given B as $P(A \text{ and } B   B)$   |

|                                    |   |
|------------------------------------|---|
|                                    | B)/P(B), and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B. ★   |
| <a href="#">MAFS.912.S-CP.1.4:</a> | Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. <i>For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.</i> ★ |
| <a href="#">MAFS.912.S-CP.1.5:</a> | Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. <i>For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.</i> ★  |
| <a href="#">MAFS.912.S-CP.2.6:</a> | Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model. ★  |
| <a href="#">MAFS.912.S-CP.2.7:</a> | Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ , and interpret the answer in terms of the model. ★   |
| <a href="#">MAFS.912.S-CP.2.8:</a> | Apply the general Multiplication Rule in a uniform probability model, $P(A \text{ and } B) = P(A)P(B A) = P(B)P(A B)$ , and interpret the answer in terms of the model. ★   |
| <a href="#">MAFS.912.S-CP.2.9:</a> | Use permutations and combinations to compute probabilities of compound events and solve problems. ★   |
| <a href="#">MAFS.912.S-MD.1.1:</a> | Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions. ★   |
| <a href="#">MAFS.912.S-MD.1.2:</a> | Calculate the expected value of a random variable; interpret it as the mean of the probability distribution. ★  |
| <a href="#">MAFS.912.S-MD.1.3:</a> | Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. <i>For example, find the theoretical probability distribution for the number of correct answers obtained by guessing on all five questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes.</i> ★  |
| <a href="#">MAFS.912.S-MD.1.4:</a> | Develop a probability distribution for a random variable defined  |

|   |  |
|---|--|
|   | <p>for a sample space in which probabilities are assigned empirically; find the expected value. <i>For example, find a current data distribution on the number of TV sets per household in the United States, and calculate the expected number of sets per household. How many TV sets would you expect to find in 100 randomly selected households?</i> ★</p>  |
| <p><a href="#">MAFS.912.S-MD.2.5:</a></p> | <p>Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values. ★</p> <ol style="list-style-type: none"> <li>Find the expected payoff for a game of chance. <i>For example, find the expected winnings from a state lottery ticket or a game at a fast-food restaurant.</i></li> <li>Evaluate and compare strategies on the basis of expected values. <i>For example, compare a high-deductible versus a low-deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident.</i></li> </ol>   |
| <p><a href="#">MAFS.912.S-MD.2.6:</a></p> | <p>Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator). ★</p>  |
| <p><a href="#">MAFS.912.S-MD.2.7:</a></p> | <p>Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game). ★</p>   |
| <p><a href="#">LAFS.910.SL.1.1:</a></p>   | <p>Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.</p> <ol style="list-style-type: none"> <li>Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.</li> <li>Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed.</li> <li>Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.</li> <li>Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and</li> </ol> |

|                                     |  |
|-------------------------------------|--|
|                                     | understanding and make new connections in light of the evidence and reasoning presented.   |
| <a href="#">LAFS.910.SL.1.2:</a>    | Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.   |
| <a href="#">LAFS.910.SL.1.3:</a>    | Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.  |
| <a href="#">LAFS.910.SL.2.4:</a>    | Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.  |
| <a href="#">LAFS.1112.RST.1.3:</a>  | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.  |
| <a href="#">LAFS.1112.RST.2.4:</a>  | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.   |
| <a href="#">LAFS.1112.RST.3.7:</a>  | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.  |
| <a href="#">LAFS.1112.WHST.1.1:</a> | <p>Write arguments focused on <i>discipline-specific content</i>.</p> <ol style="list-style-type: none"> <li>a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.</li> <li>b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience’s knowledge level, concerns, values, and possible biases.</li> <li>c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.</li> <li>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the</li> </ol> |

- discipline in which they are writing.
- e. Provide a concluding statement or section that follows from or supports the argument presented.

[LAFS.1112.WHST.2.4:](#)

Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

[LAFS.1112.WHST.3.9:](#)

Draw evidence from informational texts to support analysis, reflection, and research.

**Make sense of problems and persevere in solving them.**

[MAFS.K12.MP.1.1:](#)

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

**Reason abstractly and quantitatively.**

[MAFS.K12.MP.2.1:](#)

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the



symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

**Construct viable arguments and critique the reasoning of others.**

[MAFS.K12.MP.3.1:](#)

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

**Model with mathematics.**

[MAFS.K12.MP.4.1:](#)

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships

mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

**Use appropriate tools strategically.**

[MAFS.K12.MP.5.1:](#)

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

**Attend to precision.**

[MAFS.K12.MP.6.1:](#)

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

[MAFS.K12.MP.7.1:](#)

**Look for and make use of structure.**

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice

that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

**Look for and express regularity in repeated reasoning.**

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

[MAFS.K12.MP.8.1:](#)

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.AC.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.

## Trigonometry Honors (#1211300)

**Version for Academic Year:** 2015 - 2016

**Course Number:** 1211300

**Abbreviated Title:** TRIG HON

**Number of Credits:** Half credit (.5)

**Course Length:** Semester (S)

**Honors?** Yes

**Course Type:** Core

**Course Level:** 3

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 9,10,11,12

**Graduation Requirement:** Mathematics

### GENERAL NOTES

#### English Language Development ELD Standards Special Notes Section:

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

### COURSE STANDARDS

| Name                               | Description   |
|------------------------------------|---|
| <a href="#">MAFS.912.N-CN.1.3:</a> | Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.   |
| <a href="#">MAFS.912.N-CN.2.4:</a> | Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number. |

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|------------------------------------|--|
| <a href="#">MAFS.912.N-CN.2.5:</a> | Represent addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the complex plane; use properties of this representation for computation. For example, $(-1 + \sqrt{3}i)^3 = 8$ because $(-1 + \sqrt{3}i)$ has modulus 2 and argument $120^\circ$ .   |
| <a href="#">MAFS.912.N-CN.2.6:</a> | Calculate the distance between numbers in the complex plane as the modulus of the difference, and the midpoint of a segment as the average of the numbers at its endpoints.  |
| <a href="#">MAFS.912.N-VM.1.1:</a> | Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., $\mathbf{v}$ , $ \mathbf{v} $ , $\ \mathbf{v}\ $ , $v$ ).   |
| <a href="#">MAFS.912.N-VM.1.2:</a> | Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.   |
| <a href="#">MAFS.912.N-VM.1.3:</a> | Solve problems involving velocity and other quantities that can be represented by vectors.   |
| <a href="#">MAFS.912.N-VM.2.4:</a> | <p>Add and subtract vectors.</p> <ol style="list-style-type: none"> <li>Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes.</li> <li>Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum.</li> <li>Understand vector subtraction <math>\mathbf{v} - \mathbf{w}</math> as <math>\mathbf{v} + (-\mathbf{w})</math>, where <math>-\mathbf{w}</math> is the additive inverse of <math>\mathbf{w}</math>, with the same magnitude as <math>\mathbf{w}</math> and pointing in the opposite direction. Represent vector subtraction graphically by connecting the tips in the appropriate order, and perform vector subtraction component-wise.</li> </ol> |
| <a href="#">MAFS.912.N-VM.2.5:</a> | <p>Multiply a vector by a scalar.</p> <ol style="list-style-type: none"> <li>Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise, e.g., as <math>c(\mathbf{v}_x, \mathbf{v}_y) = (c\mathbf{v}_x, c\mathbf{v}_y)</math>.</li> <li>Compute the magnitude of a scalar multiple <math>c\mathbf{v}</math> using <math>\ c\mathbf{v}\  =  c v</math>. Compute the direction of <math>c\mathbf{v}</math> knowing that when <math> c v \neq 0</math>, the direction of <math>c\mathbf{v}</math> is either along <math>\mathbf{v}</math> (for <math>c &gt; 0</math>) or against <math>\mathbf{v}</math> (for <math>c &lt; 0</math>).</li> </ol>   |
| <a href="#">MAFS.912.F-TF.1.1:</a> | Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle; Convert between  |

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|                                      | degrees and radians.   |
| <a href="#">MAFS.912.F-TF.1.2:</a>   | Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.  |
| <a href="#">MAFS.912.F-TF.1.3:</a>   | Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$ , $\pi/4$ and $\pi/6$ , and use the unit circle to express the values of sine, cosine, and tangent for $\pi-x$ , $\pi+x$ , and $2\pi-x$ in terms of their values for $x$ , where $x$ is any real number.  |
| <a href="#">MAFS.912.F-TF.1.4:</a>   | Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.   |
| <a href="#">MAFS.912.F-TF.2.5:</a>   | Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline. ★   |
| <a href="#">MAFS.912.F-TF.2.6:</a>   | Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.   |
| <a href="#">MAFS.912.F-TF.2.7:</a>   | Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context. ★   |
| <a href="#">MAFS.912.F-TF.3.8:</a>   | Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to calculate trigonometric ratios.   |
| <a href="#">MAFS.912.F-TF.3.9:</a>   | Prove the addition and subtraction, half-angle, and double-angle formulas for sine, cosine, and tangent and use these formulas to solve problems.  |
| <a href="#">MAFS.912.G-SRT.3.7:</a>  | Explain and use the relationship between the sine and cosine of complementary angles.  |
| <a href="#">MAFS.912.G-SRT.3.8:</a>  | Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. ★   |
| <a href="#">MAFS.912.G-SRT.4.9:</a>  | Derive the formula $A = 1/2 ab \sin(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.  |
| <a href="#">MAFS.912.G-SRT.4.10:</a> | Prove the Laws of Sines and Cosines and use them to solve problems.  |
| <a href="#">LAFS.910.SL.1.1:</a>     | <p>Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.</p> <p>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful,</p> |

|                                     |  |
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|                                     | <p>well-reasoned exchange of ideas.</p> <p>b. Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed.</p> <p>c. Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.</p> <p>d. Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.</p> |
| <a href="#">LAFS.910.SL.1.2:</a>    | Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.   |
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| <a href="#">LAFS.1112.WHST.1.1:</a> | <p>Write arguments focused on <i>discipline-specific content</i>.</p> <p>a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.</p> <p>b. Develop claim(s) and counterclaims fairly and</p>   |

thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.

- c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.
- d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
- e. Provide a concluding statement or section that follows from or supports the argument presented.

[LAFS.1112.WHST.2.4:](#)

Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

[LAFS.1112.WHST.3.9:](#)

Draw evidence from informational texts to support analysis, reflection, and research.

**Make sense of problems and persevere in solving them.**

[MAFS.K12.MP.1.1:](#)

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" They can understand the



approaches of others to solving complex problems and identify correspondences between different approaches.

**Reason abstractly and quantitatively.**

[MAFS.K12.MP.2.1:](#)

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

**Construct viable arguments and critique the reasoning of others.**

[MAFS.K12.MP.3.1:](#)

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

[MAFS.K12.MP.4.1:](#)

**Model with mathematics.**

Mathematically proficient students can apply the mathematics

they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

**Use appropriate tools strategically.**

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

[MAFS.K12.MP.5.1:](#)

**Attend to precision.**

[MAFS.K12.MP.6.1:](#)

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the

symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

**Look for and make use of structure.**

[MAFS.K12.MP.7.1:](#)

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

**Look for and express regularity in repeated reasoning.**

[MAFS.K12.MP.8.1:](#)

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through  $(1, 2)$  with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.AC.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.

## **M/J Grade 6 Mathematics (#1205010)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 1205010

**Abbreviated Title:** M/J GRADE 6 MATH

**Course Length:** Year (Y)

**Course Type:** Core

**Course Level:** 2

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 6,7,8

### **GENERAL NOTES**

#### **MAFS.6**

In Grade 6, instructional time should focus on four critical areas: (1) connecting ratio and rate to whole number multiplication and division and using concepts of ratio and rate to solve problems; (2) completing understanding of division of fractions and extending the notion of number to the system of rational numbers, which includes negative numbers; (3) writing, interpreting, and using expressions and equations; and (4) developing understanding of statistical thinking.

1. Students use reasoning about multiplication and division to solve ratio and rate problems about quantities. By viewing equivalent ratios and rates as deriving from, and extending, pairs of rows (or columns) in the multiplication table, and by analyzing simple drawings that indicate the relative size of quantities, students connect their understanding of multiplication and division with ratios and rates. Thus students expand the scope of problems for which they can use multiplication and division to solve problems, and they connect ratios and fractions. Students solve a wide variety of problems involving ratios and rates.
2. Students use the meaning of fractions, the meanings of multiplication and division, and the relationship between multiplication and division to understand and explain why the procedures for dividing fractions make sense. Students use these operations to solve problems. Students extend their previous understandings of number and the ordering of numbers to the full system of rational numbers, which includes negative rational numbers, and in particular negative integers. They reason about the order and absolute value of rational numbers and about the location of points in all four quadrants of the coordinate plane.

3. Students understand the use of variables in mathematical expressions. They write expressions and equations that correspond to given situations, evaluate expressions, and use expressions and formulas to solve problems. Students understand that expressions in different forms can be equivalent, and they use the properties of operations to rewrite expressions in equivalent forms. Students know that the solutions of an equation are the values of the variables that make the equation true. Students use properties of operations and the idea of maintaining the equality of both sides of an equation to solve simple one-step equations. Students construct and analyze tables, such as tables of quantities that are equivalent ratios, and they use equations (such as  $3x = y$ ) to describe relationships between quantities.
  
4. Building on and reinforcing their understanding of number, students begin to develop their ability to think statistically. Students recognize that a data distribution may not have a definite center and that different ways to measure center yield different values. The median measures center in the sense that it is roughly the middle value. The mean measures center in the sense that it is the value that each data point would take on if the total of the data values were redistributed equally, and also in the sense that it is a balance point. Students recognize that a measure of variability (interquartile range or mean absolute deviation) can also be useful for summarizing data because two very different set of data can have the same mean and median yet be distinguished by their variability. Students learn to describe and summarize numerical data sets, identifying clusters, peaks, gaps, and symmetry, considering the context in which the data were collected.

Students in Grade 6 also build on their work with area in elementary school by reasoning about relationships among shapes to determine area, surface area, and volume. They find areas of right triangles, other triangles, and special quadrilaterals by decomposing these shapes, rearranging or removing pieces, and relating the shapes to rectangles. Using these methods, students discuss, develop, and justify formulas for areas of triangles and parallelograms. Students find areas of polygons and surface areas of prisms and pyramids by decomposing them into pieces whose area they can determine. They reason about right rectangular prisms with fractional side lengths to extend formulas for the volume of a right rectangular prism to fractional side lengths. They prepare for work on scale drawings and constructions in Grade 7 by drawing polygons in the coordinate plane.

**English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts

for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

## COURSE STANDARDS

| Name                           | Description   |
|--------------------------------|---|
| <a href="#">MAFS.6.RP.1.1:</a> | Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. <i>For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes."</i>   |
| <a href="#">MAFS.6.RP.1.2:</a> | Understand the concept of a unit rate $a/b$ associated with a ratio $a:b$ with $b \neq 0$ , and use rate language in the context of a ratio relationship. <i>For example, "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is <math>3/4</math> cup of flour for each cup of sugar." "We paid \$75 for 15 hamburgers, which is a rate of \$5 per hamburger."</i>   |
| <a href="#">MAFS.6.RP.1.3:</a> | Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations. <ol style="list-style-type: none"> <li>a. Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.</li> <li>b. Solve unit rate problems including those involving unit pricing and constant speed. <i>For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?</i></li> <li>c. Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means <math>30/100</math> times the quantity); solve problems involving finding the whole, given a part and the percent.</li> <li>d. Use ratio reasoning to convert measurement units;</li> </ol> |

manipulate and transform units appropriately when multiplying or dividing quantities.

- e. Understand the concept of Pi as the ratio of the circumference of a circle to its diameter.

<sup>1</sup>See [Table 2 Common Multiplication and Division Situations](#)

**Remarks/Examples:**

**Examples of Opportunities for In-Depth Focus**

When students work toward meeting this standard, they use a range of reasoning and representations to analyze proportional relationships.

Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. *For example, create a story context for  $(2/3) \div (3/4)$  and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that  $(2/3) \div (3/4) = 8/9$  because  $3/4$  of  $8/9$  is  $2/3$ . (In general,  $(a/b) \div (c/d) = ad/bc$ .) How much chocolate will each person get if 3 people share  $1/2$  lb of chocolate equally? How many  $3/4$ -cup servings are in  $2/3$  of a cup of yogurt? How wide is a rectangular strip of land with length  $3/4$  mi and area  $1/2$  square mi?*

[MAFS.6.NS.1.1:](#)

**Remarks/Examples:**

**Examples of Opportunities for In-Depth Focus**

This is a culminating standard for extending multiplication and division to fractions.

**Fluency Expectations or Examples of Culminating Standards**

Students interpret and compute quotients of fractions and solve word problems involving division of fractions by fractions. This completes the extension of operations to fractions.

Fluently divide multi-digit numbers using the standard algorithm.

[MAFS.6.NS.2.2:](#)

**Remarks/Examples:**

**Fluency Expectations or Examples of Culminating Standards**



Students fluently divide multi-digit numbers using the standard algorithm. This is the culminating standard for several years' worth of work with division of whole numbers.

Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.

[MAFS.6.NS.2.3:](#)

**Remarks/Examples:  
Fluency Expectations or Examples of Culminating Standards**

Students fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation. This is the culminating standard for several years' worth of work relating to the domains of Number and Operations in Base Ten, Operations and Algebraic Thinking, and Number and Operations — Fractions.

[MAFS.6.NS.2.4:](#)

Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor. *For example, express  $36 + 8$  as  $4(9 + 2)$ .*

[MAFS.6.NS.3.5:](#)

Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.

[MAFS.6.NS.3.6:](#)

Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates.

- a. Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself, e.g.,  $-(-3) = 3$ , and that 0 is its own opposite.
- b. Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one

or both axes.

- c. Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.

Understand ordering and absolute value of rational numbers.

- a. Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram. *For example, interpret  $-3 > -7$  as a statement that  $-3$  is located to the right of  $-7$  on a number line oriented from left to right.*
- b. Write, interpret, and explain statements of order for rational numbers in real-world contexts. *For example, write  $-3^{\circ}\text{C} > -7^{\circ}\text{C}$  to express the fact that  $-3^{\circ}\text{C}$  is warmer than  $-7^{\circ}\text{C}$ .*

[MAFS.6.NS.3.7:](#)

- c. Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation. *For example, for an account balance of  $-30$  dollars, write  $|-30| = 30$  to describe the size of the debt in dollars.*
- d. Distinguish comparisons of absolute value from statements about order. *For example, recognize that an account balance less than  $-30$  dollars represents a debt greater than 30 dollars.*

Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.

[MAFS.6.NS.3.8:](#)

**Remarks/Examples:  
Examples of Opportunities for In-Depth Focus**

When students work with rational numbers in the coordinate plane to solve problems, they combine and consolidate elements from the other standards in this cluster.

[MAFS.6.EE.1.1:](#)

Write and evaluate numerical expressions involving whole-number exponents.

Write, read, and evaluate expressions in which letters stand for numbers.

- a. Write expressions that record operations with numbers and with letters standing for numbers. *For example, express the calculation “Subtract  $y$  from 5” as  $5 - y$ .*
- b. Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity. *For example, describe the expression  $2(8 + 7)$  as a product of two factors; view  $(8 + 7)$  as both a single entity and a sum of two terms.*
- c. Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). *For example, use the formulas  $V = s^3$  and  $A = 6s^2$  to find the volume and surface area of a cube with sides of length  $s = 1/2$ .*

[MAFS.6.EE.1.2:](#)

Apply the properties of operations to generate equivalent expressions. *For example, apply the distributive property to the expression  $3(2 + x)$  to produce the equivalent expression  $6 + 3x$ ; apply the distributive property to the expression  $24x + 18y$  to produce the equivalent expression  $6(4x + 3y)$ ; apply properties of operations to  $y + y + y$  to produce the equivalent expression  $3y$ .*

[MAFS.6.EE.1.3:](#)

**Remarks/Examples:  
Examples of Opportunities for In-Depth Focus**

By applying properties of operations to generate equivalent expressions, students use properties of operations that they are familiar with from previous grades’ work with numbers — generalizing arithmetic in the process.

[MAFS.6.EE.1.4:](#)

Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them). *For example, the expressions  $y + y + y$  and*

*3y are equivalent because they name the same number regardless of which number y stands for.*

[MAFS.6.EE.2.5:](#)

Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.

[MAFS.6.EE.2.6:](#)

Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.

[MAFS.6.EE.2.7:](#)

Solve real-world and mathematical problems by writing and solving equations of the form  $x + p = q$  and  $px = q$  for cases in which  $p$ ,  $q$  and  $x$  are all non-negative rational numbers.

**Remarks/Examples:  
Examples of Opportunities for In-Depth Focus**

When students write equations of the form  $x + p = q$  and  $px = q$  to solve real-world and mathematical problems, they draw on meanings of operations that they are familiar with from previous grades' work. They also begin to learn algebraic approaches to solving problems.<sup>16</sup>

<sup>16</sup> For example, suppose Daniel went to visit his grandmother, who gave him \$5.50. Then he bought a book costing \$9.20 and had \$2.30 left. To find how much money he had before visiting his grandmother, an algebraic approach leads to the equation  $x + 5.50 - 9.20 = 2.30$ . An arithmetic approach without using variables at all would be to begin with 2.30, then add 9.20, then subtract 5.50. This yields the desired answer, but students will eventually encounter problems in which arithmetic approaches are unrealistically difficult and algebraic approaches must be used.

[MAFS.6.EE.2.8:](#)

Write an inequality of the form  $x > c$  or  $x < c$  to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form  $x > c$  or  $x < c$  have infinitely many solutions; represent solutions of such inequalities on number line diagrams.

[MAFS.6.EE.3.9:](#)

Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent

|                                |   |
|--------------------------------|---|
|                                | variables using graphs and tables, and relate these to the equation. <i>For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation <math>d = 65t</math> to represent the relationship between distance and time.</i>   |
| <a href="#">MAFS.6.G.1.1:</a>  | Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.   |
| <a href="#">MAFS.6.G.1.2:</a>  | Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas $V = l w h$ and $V = B h$ to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems. |
| <a href="#">MAFS.6.G.1.3:</a>  | Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems.  |
| <a href="#">MAFS.6.G.1.4:</a>  | Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.  |
| <a href="#">MAFS.6.SP.1.1:</a> | Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. <i>For example, "How old am I?" is not a statistical question, but "How old are the students in my school?" is a statistical question because one anticipates variability in students' ages.</i>   |
| <a href="#">MAFS.6.SP.1.2:</a> | Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.  |
| <a href="#">MAFS.6.SP.1.3:</a> | Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.   |
| <a href="#">MAFS.6.SP.2.4:</a> | Display numerical data in plots on a number line, including dot plots, histograms, and box plots.   |
| <a href="#">MAFS.6.SP.2.5:</a> | Summarize numerical data sets in relation to their context, such as by: <ul style="list-style-type: none"> <li>a. Reporting the number of observations.</li> <li>b. Describing the nature of the attribute under investigation,</li> </ul>  |

including how it was measured and its units of measurement.

- c. Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.
- d. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.

[LAFS.6.SL.1.1:](#)

Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly.

- a. Come to discussions prepared, having read or studied required material; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.
- b. Follow rules for collegial discussions, set specific goals and deadlines, and define individual roles as needed.
- c. Pose and respond to specific questions with elaboration and detail by making comments that contribute to the topic, text, or issue under discussion.
- d. Review the key ideas expressed and demonstrate understanding of multiple perspectives through reflection and paraphrasing.

[LAFS.6.SL.1.2:](#)

Interpret information presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how it contributes to a topic, text, or issue under study.

[LAFS.6.SL.1.3:](#)

Delineate a speaker's argument and specific claims, distinguishing claims that are supported by reasons and evidence from claims that are not.

[LAFS.6.SL.2.4:](#)

Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume, and clear pronunciation.

[LAFS.68.RST.1.3:](#)

Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

[LAFS.68.RST.2.4:](#)

Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.

[LAFS.68.RST.3.7:](#)

Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

Write arguments focused on *discipline-specific content*.

[LAFS.68.WHST.1.1:](#)

- a. Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.
- b. Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.
- c. Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.
- d. Establish and maintain a formal style.
- e. Provide a concluding statement or section that follows from and supports the argument presented.

[LAFS.68.WHST.2.4:](#)

Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

**Make sense of problems and persevere in solving them.**

[MAFS.K12.MP.1.1:](#)

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

|   |   |
|---|---|
| <p><a href="#">MAFS.K12.MP.2.1:</a></p> | <p><b>Reason abstractly and quantitatively.</b></p> <p>Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.</p>  |
| <p><a href="#">MAFS.K12.MP.3.1:</a></p> | <p><b>Construct viable arguments and critique the reasoning of others.</b></p> <p>Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.</p> |
| <p><a href="#">MAFS.K12.MP.4.1:</a></p> | <p><b>Model with mathematics.</b></p> <p>Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a</p>   |



student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

**Use appropriate tools strategically.**

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

[MAFS.K12.MP.5.1:](#)

**Attend to precision.**

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express

[MAFS.K12.MP.6.1:](#)

|                                   |   |
|-----------------------------------|---|
|                                   | numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.   |
|                                   | <p><b>Look for and make use of structure.</b></p> <p>Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see <math>7 \times 8</math> equals the well remembered <math>7 \times 5 + 7 \times 3</math>, in preparation for learning about the distributive property. In the expression <math>x^2 + 9x + 14</math>, older students can see the 14 as <math>2 \times 7</math> and the 9 as <math>2 + 7</math>. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see <math>5 - 3(x - y)^2</math> as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers <math>x</math> and <math>y</math>.</p> |
| <a href="#">MAFS.K12.MP.7.1:</a>  |   |
|                                   | <p><b>Look for and express regularity in repeated reasoning.</b></p> <p>Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation <math>(y - 2)/(x - 1) = 3</math>. Noticing the regularity in the way terms cancel when expanding <math>(x - 1)(x + 1)</math>, <math>(x - 1)(x^2 + x + 1)</math>, and <math>(x - 1)(x^3 + x^2 + x + 1)</math> might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.</p>   |
| <a href="#">MAFS.K12.MP.8.1:</a>  |   |
| <a href="#">ELD.K12.ELL.1.1:</a>  | English language learners communicate for social and instructional purposes within the school setting.  |
| <a href="#">ELD.K12.ELL.AC.1:</a> | English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.  |



## **M/J Grade 6 Mathematics Advanced (#1205020)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 1205020

**Abbreviated Title:** M/J GRADE 6 MATH ADV

**Course Length:** Year (Y)

**Course Type:** Core

**Course Level:** 2

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 6,7,8

### **VERSION DESCRIPTION**

Students enrolled in:

- Grade 6 Mathematics or Grade 6 Mathematics Advanced will take the Grade 6 Florida Standards Assessment.
- Grade 7 Mathematics or Grade 7 Mathematics Advanced will take the Grade 7 Florida Standards Assessment.

### **GENERAL NOTES**

MAFS.6

In this Grade 6 Advanced Mathematics course, instructional time should focus on six critical areas: (1) connecting ratio and rate to whole number multiplication and division and using concepts of ratio and rate to solve problems; (2) completing understanding of division of fractions and extending the notion of number to the system of rational numbers, which includes negative numbers; (3) writing, interpreting, and using expressions and equations; (4) developing understanding of statistical thinking; (5) developing understanding of and applying proportional relationships; and (6) developing understanding of operations with rational numbers and working with expressions and linear equations.

1. Students use reasoning about multiplication and division to solve ratio and rate problems about quantities. By viewing equivalent ratios and rates as deriving from, and extending, pairs of rows (or columns) in the multiplication table, and by analyzing simple drawings that indicate the relative size of quantities, students connect their understanding of multiplication and division with ratios and rates. Thus students expand the scope of problems for which they can use multiplication and division to solve problems, and they connect ratios and fractions. Students solve a wide variety of problems involving ratios and rates.

2. Students use the meaning of fractions, the meanings of multiplication and division, and the relationship between multiplication and division to understand and explain why the procedures for dividing fractions make sense. Students use these operations to solve problems. Students extend their previous understandings of number and the ordering of numbers to the full system of rational numbers, which includes negative rational numbers, and in particular negative integers. They reason about the order and absolute value of rational numbers and about the location of points in all four quadrants of the coordinate plane.
  
3. Students understand the use of variables in mathematical expressions. They write expressions and equations that correspond to given situations, evaluate expressions, and use expressions and formulas to solve problems. Students understand that expressions in different forms can be equivalent, and they use the properties of operations to rewrite expressions in equivalent forms. Students know that the solutions of an equation are the values of the variables that make the equation true. Students use properties of operations and the idea of maintaining the equality of both sides of an equation to solve simple one-step equations. Students construct and analyze tables, such as tables of quantities that are equivalent ratios, and they use equations (such as  $3x = y$ ) to describe relationships between quantities.
  
4. Building on and reinforcing their understanding of number, students begin to develop their ability to think statistically. Students recognize that a data distribution may not have a definite center and that different ways to measure center yield different values. The median measures center in the sense that it is roughly the middle value. The mean measures center in the sense that it is the value that each data point would take on if the total of the data values were redistributed equally, and also in the sense that it is a balance point. Students recognize that a measure of variability (interquartile range or mean absolute deviation) can also be useful for summarizing data because two very different set of data can have the same mean and median yet be distinguished by their variability. Students learn to describe and summarize numerical data sets, identifying clusters, peaks, gaps, and symmetry, considering the context in which the data were collected.
  
5. Students extend their understanding of ratios and develop understanding of proportionality to solve single- and multi-step problems. Students use their understanding of ratios and proportionality to solve a wide variety of percent

problems, including those involving discounts, interest, taxes, tips, and percent increase or decrease. Students solve problems about scale drawings by relating corresponding lengths between the objects or by using the fact that relationships of lengths within an object are preserved in similar objects. Students graph proportional relationships and understand the unit rate informally as a measure of the steepness of the related line, called the slope. They distinguish proportional relationships from other relationships.

6. Students develop a unified understanding of number, recognizing fractions, decimals (that have a finite or a repeating decimal representation), and percents as different representations of rational numbers. Students extend addition, subtraction, multiplication, and division to all rational numbers, maintaining the properties of operations and the relationships between addition and subtraction, and multiplication and division. By applying these properties, and by viewing negative numbers in terms of everyday contexts (e.g., amounts owed or temperatures below zero), students explain and interpret the rules for adding, subtracting, multiplying, and dividing with negative numbers. They use the arithmetic of rational numbers as they formulate expressions and equations in one variable and use these equations to solve problems.

Students in Grade 6 also build on their work with area in elementary school by reasoning about relationships among shapes to determine area, surface area, and volume. They find areas of right triangles, other triangles, and special quadrilaterals by decomposing these shapes, rearranging or removing pieces, and relating the shapes to rectangles. Using these methods, students discuss, develop, and justify formulas for areas of triangles and parallelograms. Students find areas of polygons and surface areas of prisms and pyramids by decomposing them into pieces whose area they can determine. They reason about right rectangular prisms with fractional side lengths to extend formulas for the volume of a right rectangular prism to fractional side lengths. They prepare for work on scale drawings and constructions in Grade 7 by drawing polygons in the coordinate plane.

**English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

## COURSE STANDARDS

| Name   | Description  |
|--|--|
| <a href="#">MAFS.6.RP.1.1:</a>   | Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. <i>For example, “The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak.” “For every vote candidate A received, candidate C received nearly three votes.”</i>  |
| <a href="#">MAFS.6.RP.1.2:</a>   | Understand the concept of a unit rate $a/b$ associated with a ratio $a:b$ with $b \neq 0$ , and use rate language in the context of a ratio relationship. <i>For example, “This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is <math>3/4</math> cup of flour for each cup of sugar.” “We paid \$75 for 15 hamburgers, which is a rate of \$5 per hamburger.”</i>  |
| <a href="#">MAFS.6.RP.1.3:</a>   | <p>Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.</p> <ol style="list-style-type: none"> <li>Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.</li> <li>Solve unit rate problems including those involving unit pricing and constant speed. <i>For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?</i></li> <li>Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means <math>30/100</math> times the quantity); solve problems involving finding the whole, given a part and the percent.</li> <li>Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.</li> <li>Understand the concept of <math>\pi</math> as the ratio of the circumference of a circle to its diameter.</li> </ol> <p>(<sup>1</sup>See <a href="#">Table 2 Common Multiplication and Division Situations</a>)</p> |
| <p><b>Remarks/Examples:</b><br/> <b>Examples of Opportunities for In-Depth Focus</b></p> |  |

When students work toward meeting this standard, they use a range of reasoning and representations to analyze proportional relationships.

Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. *For example, create a story context for  $(2/3) \div (3/4)$  and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that  $(2/3) \div (3/4) = 8/9$  because  $3/4$  of  $8/9$  is  $2/3$ . (In general,  $(a/b) \div (c/d) = ad/bc$ .) How much chocolate will each person get if 3 people share  $1/2$  lb of chocolate equally? How many  $3/4$ -cup servings are in  $2/3$  of a cup of yogurt? How wide is a rectangular strip of land with length  $3/4$  mi and area  $1/2$  square mi?*

[MAFS.6.NS.1.1:](#)

**Remarks/Examples:  
Examples of Opportunities for In-Depth Focus**

This is a culminating standard for extending multiplication and division to fractions.

**Fluency Expectations or Examples of Culminating Standards**

Students interpret and compute quotients of fractions and solve word problems involving division of fractions by fractions. This completes the extension of operations to fractions.

Fluently divide multi-digit numbers using the standard algorithm.

[MAFS.6.NS.2.2:](#)

**Remarks/Examples:  
Fluency Expectations or Examples of Culminating Standards**

Students fluently divide multi-digit numbers using the standard algorithm. This is the culminating standard for several years' worth of work with division of whole numbers.

[MAFS.6.NS.2.3:](#)

Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.



**Remarks/Examples:  
Fluency Expectations or Examples of Culminating  
Standards**

Students fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation. This is the culminating standard for several years' worth of work relating to the domains of Number and Operations in Base Ten, Operations and Algebraic Thinking, and Number and Operations — Fractions.

[MAFS.6.NS.2.4:](#)

Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor. *For example, express  $36 + 8$  as  $4(9 + 2)$ .*

[MAFS.6.NS.3.5:](#)

Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.

[MAFS.6.NS.3.6:](#)

Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates.

- a. Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself, e.g.,  $-(-3) = 3$ , and that 0 is its own opposite.
- b. Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes.
- c. Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.

[MAFS.6.NS.3.7:](#)

Understand ordering and absolute value of rational numbers.

- a. Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram. *For example, interpret  $-3 > -7$  as a statement that  $-3$  is located to the right of  $-7$  on a number line oriented from left to right.*
- b. Write, interpret, and explain statements of order for rational numbers in real-world contexts. *For example, write  $-3^{\circ}\text{C} > -7^{\circ}\text{C}$  to express the fact that  $-3^{\circ}\text{C}$  is warmer than  $-7^{\circ}\text{C}$ .*
- c. Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation. *For example, for an account balance of  $-30$  dollars, write  $|-30| = 30$  to describe the size of the debt in dollars.*
- d. Distinguish comparisons of absolute value from statements about order. *For example, recognize that an account balance less than  $-30$  dollars represents a debt greater than 30 dollars.*

Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.

[MAFS.6.NS.3.8:](#)

**Remarks/Examples:  
Examples of Opportunities for In-Depth Focus**

When students work with rational numbers in the coordinate plane to solve problems, they combine and consolidate elements from the other standards in this cluster.

[MAFS.6.EE.1.1:](#)

Write and evaluate numerical expressions involving whole-number exponents.

[MAFS.6.EE.1.2:](#)

Write, read, and evaluate expressions in which letters stand for numbers.

- a. Write expressions that record operations with numbers and with letters standing for numbers. *For example, express the calculation “Subtract  $y$  from 5” as  $5 - y$ .*
- b. Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity. *For example, describe the expression  $2(8 + 7)$  as a product of two factors; view  $(8 + 7)$  as both a single entity and a sum of two terms.*
- c. Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). *For example, use the formulas  $V = s^3$  and  $A = 6s^2$  to find the volume and surface area of a cube with sides of length  $s = 1/2$ .*

Apply the properties of operations to generate equivalent expressions. *For example, apply the distributive property to the expression  $3(2 + x)$  to produce the equivalent expression  $6 + 3x$ ; apply the distributive property to the expression  $24x + 18y$  to produce the equivalent expression  $6(4x + 3y)$ ; apply properties of operations to  $y + y + y$  to produce the equivalent expression  $3y$ .*

[MAFS.6.EE.1.3:](#)

**Remarks/Examples:  
Examples of Opportunities for In-Depth Focus**

By applying properties of operations to generate equivalent expressions, students use properties of operations that they are familiar with from previous grades’ work with numbers — generalizing arithmetic in the process.

[MAFS.6.EE.1.4:](#)

Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them). *For example, the expressions  $y + y + y$  and  $3y$  are equivalent because they name the same number regardless of which number  $y$  stands for.*

[MAFS.6.EE.2.5:](#)

Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.

[MAFS.6.EE.2.6:](#)

Use variables to represent numbers and write expressions when

solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.

Solve real-world and mathematical problems by writing and solving equations of the form  $x + p = q$  and  $px = q$  for cases in which  $p$ ,  $q$  and  $x$  are all non-negative rational numbers.

[MAFS.6.EE.2.7:](#)

**Remarks/Examples:  
Examples of Opportunities for In-Depth Focus**

When students write equations of the form  $x + p = q$  and  $px = q$  to solve real-world and mathematical problems, they draw on meanings of operations that they are familiar with from previous grades' work. They also begin to learn algebraic approaches to solving problems.<sup>16</sup>

<sup>16</sup> For example, suppose Daniel went to visit his grandmother, who gave him \$5.50. Then he bought a book costing \$9.20 and had \$2.30 left. To find how much money he had before visiting his grandmother, an algebraic approach leads to the equation  $x + 5.50 - 9.20 = 2.30$ . An arithmetic approach without using variables at all would be to begin with 2.30, then add 9.20, then subtract 5.50. This yields the desired answer, but students will eventually encounter problems in which arithmetic approaches are unrealistically difficult and algebraic approaches must be used.

[MAFS.6.EE.2.8:](#)

Write an inequality of the form  $x > c$  or  $x < c$  to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form  $x > c$  or  $x < c$  have infinitely many solutions; represent solutions of such inequalities on number line diagrams.

[MAFS.6.EE.3.9:](#)

Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. *For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation  $d = 65t$  to represent the relationship between distance and time.*

[MAFS.6.G.1.1:](#)

Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these

|                                |  |
|--------------------------------|--|
|                                | techniques in the context of solving real-world and mathematical problems.   |
| <a href="#">MAFS.6.G.1.2:</a>  | Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas $V = l w h$ and $V = B h$ to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.  |
| <a href="#">MAFS.6.G.1.3:</a>  | Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems.   |
| <a href="#">MAFS.6.G.1.4:</a>  | Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.   |
| <a href="#">MAFS.6.SP.1.1:</a> | Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. <i>For example, "How old am I?" is not a statistical question, but "How old are the students in my school?" is a statistical question because one anticipates variability in students' ages.</i>  |
| <a href="#">MAFS.6.SP.1.2:</a> | Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.   |
| <a href="#">MAFS.6.SP.1.3:</a> | Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.  |
| <a href="#">MAFS.6.SP.2.4:</a> | Display numerical data in plots on a number line, including dot plots, histograms, and box plots.  |
| <a href="#">MAFS.6.SP.2.5:</a> | Summarize numerical data sets in relation to their context, such as by: <ul style="list-style-type: none"> <li>a. Reporting the number of observations.</li> <li>b. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.</li> <li>c. Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.</li> </ul> |

- d. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.

[MAFS.7.RP.1.1:](#)

Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. *For example, if a person walks 1/2 mile in each 1/4 hour, compute the unit rate as the complex fraction 1/2/1/4 miles per hour, equivalently 2 miles per hour.*

Recognize and represent proportional relationships between quantities.

- a. Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.
- b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.
- c. Represent proportional relationships by equations. *For example, if total cost  $t$  is proportional to the number  $n$  of items purchased at a constant price  $p$ , the relationship between the total cost and the number of items can be expressed as  $t = pn$ .*
- d. Explain what a point  $(x, y)$  on the graph of a proportional relationship means in terms of the situation, with special attention to the points  $(0, 0)$  and  $(1, r)$  where  $r$  is the unit rate.

[MAFS.7.RP.1.2:](#)

**Remarks/Examples:**

**Examples of Opportunities for In-Depth Focus**

Students in grade 7 grow in their ability to recognize, represent, and analyze proportional relationships in various ways, including by using tables, graphs, and equations.

[MAFS.7.RP.1.3:](#)

Use proportional relationships to solve multistep ratio and percent problems. *Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.*

[MAFS.7.NS.1.1:](#)

Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.

- a. Describe situations in which opposite quantities combine to make 0. *For example, a hydrogen atom has 0 charge because its two constituents are oppositely charged.*
- b. Understand  $p + q$  as the number located a distance  $|q|$  from  $p$ , in the positive or negative direction depending on whether  $q$  is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts.
- c. Understand subtraction of rational numbers as adding the additive inverse,  $p - q = p + (-q)$ . Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.
- d. Apply properties of operations as strategies to add and subtract rational numbers.

**Remarks/Examples:  
Fluency Expectations or Examples of Culminating Standards**

Adding, subtracting, multiplying, and dividing rational numbers is the culmination of numerical work with the four basic operations. The number system will continue to develop in grade 8, expanding to become the real numbers by the introduction of irrational numbers, and will develop further in high school, expanding to become the complex numbers with the introduction of imaginary numbers. Because there are no specific standards for rational number arithmetic in later grades and because so much other work in grade 7 depends on rational number arithmetic, fluency with rational number arithmetic should be the goal in grade 7.

[MAFS.7.NS.1.2:](#)

Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.

- a. Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as  $(-1)(-1) = 1$  and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts.

- b. Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If  $p$  and  $q$  are integers, then  $-(p/q) = (-p)/q = p/(-q)$ . Interpret quotients of rational numbers by describing real-world contexts.
- c. Apply properties of operations as strategies to multiply and divide rational numbers.
- d. Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.

**Remarks/Examples:  
Fluency Expectations or Examples of Culminating Standards**

Adding, subtracting, multiplying, and dividing rational numbers is the culmination of numerical work with the four basic operations. The number system will continue to develop in grade 8, expanding to become the real numbers by the introduction of irrational numbers, and will develop further in high school, expanding to become the complex numbers with the introduction of imaginary numbers. Because there are no specific standards for rational number arithmetic in later grades and because so much other work in grade 7 depends on rational number arithmetic, fluency with rational number arithmetic should be the goal in grade 7.

Solve real-world and mathematical problems involving the four operations with rational numbers.

[MAFS.7.NS.1.3:](#)

**Remarks/Examples:  
Examples of Opportunities for In-Depth Focus**

When students work toward meeting this standard (which is closely connected to 7.NS.1.1 and 7.NS.1.2), they consolidate their skill and understanding of addition, subtraction, multiplication and division of rational numbers.

[MAFS.7.EE.1.1:](#)

Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.

[MAFS.7.EE.1.2:](#)

Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. *For example,  $a + 0.05a = 1.05a$  means that “increase by 5%” is the same as “multiply by 1.05.”*



|  |  |
|--|--|
| <p><a href="#">LAFS.6.SL.1.1:</a></p>    | <p>Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly.</p> <ol style="list-style-type: none"> <li>a. Come to discussions prepared, having read or studied required material; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.</li> <li>b. Follow rules for collegial discussions, set specific goals and deadlines, and define individual roles as needed.</li> <li>c. Pose and respond to specific questions with elaboration and detail by making comments that contribute to the topic, text, or issue under discussion.</li> <li>d. Review the key ideas expressed and demonstrate understanding of multiple perspectives through reflection and paraphrasing.</li> </ol> |
| <p><a href="#">LAFS.6.SL.1.2:</a></p>    | <p>Interpret information presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how it contributes to a topic, text, or issue under study.</p>  |
| <p><a href="#">LAFS.6.SL.1.3:</a></p>    | <p>Delineate a speaker's argument and specific claims, distinguishing claims that are supported by reasons and evidence from claims that are not.</p>  |
| <p><a href="#">LAFS.6.SL.2.4:</a></p>    | <p>Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume, and clear pronunciation.</p>   |
| <p><a href="#">LAFS.68.RST.1.3:</a></p>  | <p>Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.</p>   |
| <p><a href="#">LAFS.68.RST.2.4:</a></p>  | <p>Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.</p>  |
| <p><a href="#">LAFS.68.RST.3.7:</a></p>  | <p>Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).</p>   |
| <p><a href="#">LAFS.68.WHST.1.1:</a></p> | <p>Write arguments focused on <i>discipline-specific content</i>.</p> <ol style="list-style-type: none"> <li>a. Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.</li> <li>b. Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.</li> <li>c. Use words, phrases, and clauses to create cohesion and</li> </ol>   |

clarify the relationships among claim(s), counterclaims, reasons, and evidence.

- d. Establish and maintain a formal style.
- e. Provide a concluding statement or section that follows from and supports the argument presented.

[LAFS.68.WHST.2.4:](#)

Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

**Make sense of problems and persevere in solving them.**

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

[MAFS.K12.MP.1.1:](#)

**Reason abstractly and quantitatively.**

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent

[MAFS.K12.MP.2.1:](#)

representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

**Construct viable arguments and critique the reasoning of others.**

[MAFS.K12.MP.3.1:](#)

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

**Model with mathematics.**

[MAFS.K12.MP.4.1:](#)

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in

the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

**Use appropriate tools strategically.**

[MAFS.K12.MP.5.1:](#)

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

**Attend to precision.**

[MAFS.K12.MP.6.1:](#)

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

**Look for and make use of structure.**

[MAFS.K12.MP.7.1:](#)

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides

the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

**Look for and express regularity in repeated reasoning.**

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

[MAFS.K12.MP.8.1:](#)

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.AC.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.

## **M/J Grade 7 Mathematics (#1205040)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 1205040

**Abbreviated Title:** M/J GRADE 7 MATH

**Course Type:** Core

**Course Level:** 2

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 6,7,8

### **GENERAL NOTES**

#### **MAFS.7**

In Grade 7, instructional time should focus on four critical areas: (1) developing understanding of and applying proportional relationships; (2) developing understanding of operations with rational numbers and working with expressions and linear equations; (3) solving problems involving scale drawings and informal geometric constructions, and working with two- and three-dimensional shapes to solve problems involving area, surface area, and volume; and (4) drawing inferences about populations based on samples.

1. Students extend their understanding of ratios and develop understanding of proportionality to solve single- and multi-step problems. Students use their understanding of ratios and proportionality to solve a wide variety of percent problems, including those involving discounts, interest, taxes, tips, and percent increase or decrease. Students solve problems about scale drawings by relating corresponding lengths between the objects or by using the fact that relationships of lengths within an object are preserved in similar objects. Students graph proportional relationships and understand the unit rate informally as a measure of the steepness of the related line, called the slope. They distinguish proportional relationships from other relationships.
2. Students develop a unified understanding of number, recognizing fractions, decimals (that have a finite or a repeating decimal representation), and percents as different representations of rational numbers. Students extend addition, subtraction, multiplication, and division to all rational numbers, maintaining the properties of operations and the relationships between addition and subtraction, and multiplication and division. By applying these properties, and by viewing negative numbers in terms of everyday contexts (e.g., amounts owed or temperatures below zero), students explain and interpret the rules for adding,

subtracting, multiplying, and dividing with negative numbers. They use the arithmetic of rational numbers as they formulate expressions and equations in one variable and use these equations to solve problems.

3. Students continue their work with area from Grade 6, solving problems involving area and circumference of a circle and surface area of three-dimensional objects. In preparation for work on congruence and similarity in Grade 8 they reason about relationships among two-dimensional figures using scale drawings and informal geometric constructions, and they gain familiarity with the relationship between angles formed by intersecting lines. Students work with three-dimensional figures, relating them to two-dimensional figures by examining cross-sections. They solve real-world and mathematical problems involving area, surface area, and volume of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes and right prisms.
4. Students build on their previous work with single data distributions to compare two data distributions and address questions about difference between populations. They begin informal work with random sampling to generate data sets and learn about the importance of representative samples for drawing inferences.

**English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

**COURSE STANDARDS**

| Name                           | Description   |
|--------------------------------|---|
| <a href="#">MAFS.7.RP.1.1:</a> | Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. <i>For example, if a person walks 1/2 mile in each 1/4 hour, compute the unit rate as the complex fraction 1/2/1/4 miles per hour, equivalently 2 miles per hour.</i>  |
| <a href="#">MAFS.7.RP.1.2:</a> | <p>Recognize and represent proportional relationships between quantities.</p> <ol style="list-style-type: none"> <li>Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.</li> <li>Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.</li> <li>Represent proportional relationships by equations. <i>For example, if total cost <math>t</math> is proportional to the number <math>n</math> of items purchased at a constant price <math>p</math>, the relationship between the total cost and the number of items can be expressed as <math>t = pn</math>.</i></li> <li>Explain what a point <math>(x, y)</math> on the graph of a proportional relationship means in terms of the situation, with special attention to the points <math>(0, 0)</math> and <math>(1, r)</math> where <math>r</math> is the unit rate.</li> </ol> <div style="border: 1px solid black; padding: 10px; margin-top: 20px;"> <p><b>Remarks/Examples:</b><br/> <b>Examples of Opportunities for In-Depth Focus</b></p> <p>Students in grade 7 grow in their ability to recognize, represent, and analyze proportional relationships in various ways, including by using tables, graphs, and equations.</p> </div> |
| <a href="#">MAFS.7.RP.1.3:</a> | Use proportional relationships to solve multistep ratio and percent problems. <i>Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.</i>   |
| <a href="#">MAFS.7.NS.1.1:</a> | <p>Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.</p> <ol style="list-style-type: none"> <li>Describe situations in which opposite quantities combine to make 0. <i>For example, a hydrogen atom has 0 charge</i></li> </ol>  |



*because its two constituents are oppositely charged.*

- b. Understand  $p + q$  as the number located a distance  $|q|$  from  $p$ , in the positive or negative direction depending on whether  $q$  is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts.
- c. Understand subtraction of rational numbers as adding the additive inverse,  $p - q = p + (-q)$ . Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.
- d. Apply properties of operations as strategies to add and subtract rational numbers.

**Remarks/Examples:**

**Fluency Expectations or Examples of Culminating Standards**

Adding, subtracting, multiplying, and dividing rational numbers is the culmination of numerical work with the four basic operations. The number system will continue to develop in grade 8, expanding to become the real numbers by the introduction of irrational numbers, and will develop further in high school, expanding to become the complex numbers with the introduction of imaginary numbers. Because there are no specific standards for rational number arithmetic in later grades and because so much other work in grade 7 depends on rational number arithmetic, fluency with rational number arithmetic should be the goal in grade 7.

Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.

[MAFS.7.NS.1.2:](#)

- a. Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as  $(-1)(-1) = 1$  and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts.
- b. Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If  $p$  and  $q$  are integers,

then  $-(p/q) = (-p)/q = p/(-q)$ . Interpret quotients of rational numbers by describing real-world contexts.

- c. Apply properties of operations as strategies to multiply and divide rational numbers.
- d. Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.

**Remarks/Examples:  
Fluency Expectations or Examples of Culminating Standards**

Adding, subtracting, multiplying, and dividing rational numbers is the culmination of numerical work with the four basic operations. The number system will continue to develop in grade 8, expanding to become the real numbers by the introduction of irrational numbers, and will develop further in high school, expanding to become the complex numbers with the introduction of imaginary numbers. Because there are no specific standards for rational number arithmetic in later grades and because so much other work in grade 7 depends on rational number arithmetic, fluency with rational number arithmetic should be the goal in grade 7.

Solve real-world and mathematical problems involving the four operations with rational numbers.

[MAFS.7.NS.1.3:](#)

**Remarks/Examples:  
Examples of Opportunities for In-Depth Focus**

When students work toward meeting this standard (which is closely connected to 7.NS.1.1 and 7.NS.1.2), they consolidate their skill and understanding of addition, subtraction, multiplication and division of rational numbers.

[MAFS.7.EE.1.1:](#)

Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.

[MAFS.7.EE.1.2:](#)

Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. *For example,  $a + 0.05a = 1.05a$  means that “increase by 5%” is the same as “multiply by 1.05.”*

[MAFS.7.EE.2.3:](#)

Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply

properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. *For example: If a woman making \$25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or \$2.50, for a new salary of \$27.50. If you want to place a towel bar  $9\frac{3}{4}$  inches long in the center of a door that is  $27\frac{1}{2}$  inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.*

**Remarks/Examples:  
Fluency Expectations or Examples of Culminating  
Standards**

Students solve multistep problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. This work is the culmination of many progressions of learning in arithmetic, problem solving and mathematical practices.

**Examples of Opportunities for In-Depth Focus**

This is a major capstone standard for arithmetic and its applications.

[MAFS.7.EE.2.4:](#)

Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.

- a. Solve word problems leading to equations of the form  $px + q = r$  and  $p(x + q) = r$ , where  $p$ ,  $q$ , and  $r$  are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. *For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?*
- b. Solve word problems leading to inequalities of the form  $px + q > r$  or  $px + q < r$ , where  $p$ ,  $q$ , and  $r$  are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. *For example: As a salesperson, you are paid \$50 per week plus \$3 per sale. This week you want your pay to be at least \$100. Write an inequality for the number of sales you need to make, and*

*describe the solutions.*

**Remarks/Examples:  
Fluency Expectations or Examples of Culminating  
Standards**

In solving word problems leading to one-variable equations of the form  $px + q = r$  and  $p(x + q) = r$ , students solve the equations fluently. This will require fluency with rational number arithmetic (7.NS.1.1–1.3), as well as fluency to some extent with applying properties operations to rewrite linear expressions with rational coefficients (7.EE.1.1).

**Examples of Opportunities for In-Depth Focus**

Work toward meeting this standard builds on the work that led to meeting 6.EE.2.7 and prepares students for the work that will lead to meeting 8.EE.3.7.

[MAFS.7.G.1.1:](#)

Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

[MAFS.7.G.1.2:](#)

Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.

[MAFS.7.G.1.3:](#)

Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.

[MAFS.7.G.2.4:](#)

Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.

[MAFS.7.G.2.5:](#)

Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure.

[MAFS.7.G.2.6:](#)

Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

**Remarks/Examples:**

### Examples of Opportunities for In-Depth Focus

Work toward meeting this standard draws together grades 3–6 work with geometric measurement.

[MAFS.7.SP.1.1:](#)

Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.

[MAFS.7.SP.1.2:](#)

Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions. *For example, estimate the mean word length in a book by randomly sampling words from the book; predict the winner of a school election based on randomly sampled survey data. Gauge how far off the estimate or prediction might be.*

[MAFS.7.SP.2.3:](#)

Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability. *For example, the mean height of players on the basketball team is 10 cm greater than the mean height of players on the soccer team, about twice the variability (mean absolute deviation) on either team; on a dot plot, the separation between the two distributions of heights is noticeable.*

[MAFS.7.SP.2.4:](#)

Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations. *For example, decide whether the words in a chapter of a seventh-grade science book are generally longer than the words in a chapter of a fourth-grade science book.*

[MAFS.7.SP.3.5:](#)

Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around  $1/2$  indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.

[MAFS.7.SP.3.6:](#)

Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability. *For example, when rolling a number cube 600 times, predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times.*

Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy.

[MAFS.7.SP.3.7:](#)

- a. Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. *For example, if a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.*
- b. Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. *For example, find the approximate probability that a spinning penny will land heads up or that a tossed paper cup will land open-end down. Do the outcomes for the spinning penny appear to be equally likely based on the observed frequencies?*

Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.

[MAFS.7.SP.3.8:](#)

- a. Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.
- b. Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., “rolling double sixes”), identify the outcomes in the sample space which compose the event.
- c. Design and use a simulation to generate frequencies for compound events. *For example, use random digits as a simulation tool to approximate the answer to the question: If 40% of donors have type A blood, what is the probability that it will take at least 4 donors to find one with type A blood?*

Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 7 topics, texts, and issues, building on others’ ideas and expressing their own clearly.

[LAFS.7.SL.1.1:](#)

- a. Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.
- b. Follow rules for collegial discussions, track progress

|                                   |   |
|-----------------------------------|---|
|                                   | <p>toward specific goals and deadlines, and define individual roles as needed.</p> <p>c. Pose questions that elicit elaboration and respond to others' questions and comments with relevant observations and ideas that bring the discussion back on topic as needed.</p> <p>d. Acknowledge new information expressed by others and, when warranted, modify their own views.</p>  |
| <a href="#">LAFS.7.SL.1.2:</a>    | Analyze the main ideas and supporting details presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how the ideas clarify a topic, text, or issue under study.  |
| <a href="#">LAFS.7.SL.1.3:</a>    | Delineate a speaker's argument and specific claims, evaluating the soundness of the reasoning and the relevance and sufficiency of the evidence.  |
| <a href="#">LAFS.7.SL.2.4:</a>    | Present claims and findings, emphasizing salient points in a focused, coherent manner with pertinent descriptions, facts, details, and examples; use appropriate eye contact, adequate volume, and clear pronunciation.   |
| <a href="#">LAFS.68.RST.1.3:</a>  | Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.   |
| <a href="#">LAFS.68.RST.2.4:</a>  | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.  |
| <a href="#">LAFS.68.RST.3.7:</a>  | Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).   |
| <a href="#">LAFS.68.WHST.1.1:</a> | <p>Write arguments focused on <i>discipline-specific content</i>.</p> <p>a. Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.</p> <p>b. Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.</p> <p>c. Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.</p> <p>d. Establish and maintain a formal style.</p> <p>e. Provide a concluding statement or section that follows from and supports the argument presented.</p> |
| <a href="#">LAFS.68.WHST.2.4:</a> | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.  |

|   |   |
|---|---|
| <p><a href="#">MAFS.K12.MP.1.1:</a></p> | <p><b>Make sense of problems and persevere in solving them.</b></p> <p>Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.</p> |
| <p><a href="#">MAFS.K12.MP.2.1:</a></p> | <p><b>Reason abstractly and quantitatively.</b></p> <p>Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.</p>  |
| <p><a href="#">MAFS.K12.MP.3.1:</a></p> | <p><b>Construct viable arguments and critique the reasoning of others.</b></p> <p>Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical</p>  |



progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

**Model with mathematics.**

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another.

[MAFS.K12.MP.4.1:](#)

Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

**Use appropriate tools strategically.**

[MAFS.K12.MP.5.1:](#)

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are

sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

**Attend to precision.**

[MAFS.K12.MP.6.1:](#)

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

**Look for and make use of structure.**

[MAFS.K12.MP.7.1:](#)

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value

cannot be more than 5 for any real numbers  $x$  and  $y$ .

**Look for and express regularity in repeated reasoning.**

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through  $(1, 2)$  with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

[MAFS.K12.MP.8.1:](#)

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.AC.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.

## **M/J Grade 7 Mathematics Advanced (#1205050)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 1205050

**Abbreviated Title:** M/J GRADE 7 MATH ADV

**Course Type:** Core

**Course Level:** 2

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 6,7,8

### **VERSION DESCRIPTION**

Students enrolled in:

- Grade 6 Mathematics or Grade 6 Mathematics Advanced will take the Grade 6 Florida Standards Assessment.
- Grade 7 Mathematics or Grade 7 Mathematics Advanced will take the Grade 7 Florida Standards Assessment.

### **GENERAL NOTES**

MAFS.7

In this Grade 7 Advanced Mathematics course, instructional time should focus on five critical area: (1) solving problems involving scale drawings and informal geometric constructions, and working with two- and three-dimensional shapes to solve problems involving area, surface area, and volume; (2) drawing inferences about populations based on samples; (3) formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations; (4) grasping the concept of a function and using functions to describe quantitative relationships; and (5) analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem.

1. Students continue their work with area from Grade 6, solving problems involving area and circumference of a circle and surface area of three-dimensional objects. In preparation for work on congruence and similarity in Grade 8 they reason about relationships among two-dimensional figures using scale drawings and informal geometric constructions, and they gain familiarity with the relationship between angles formed by intersecting lines. Students work with three-dimensional figures, relating them to two-dimensional figures by examining cross-sections. They solve real-world and mathematical problems involving area,

surface area, and volume of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes and right prisms.

2. Students build on their previous work with single data distributions to compare two data distributions and address questions about difference between populations. They begin informal work with random sampling to generate data sets and learn about the importance of representative samples for drawing inferences.
3. Students use linear equations and systems of linear equations to represent, analyze, and solve a variety of problems. Students recognize equations for proportions ( $y/x = m$  or  $y = mx$ ) as special linear equations ( $y = mx + b$ ), understanding that the constant of proportionality ( $m$ ) is the slope, and the graphs are lines through the origin. They understand that the slope ( $m$ ) of a line is a constant rate of change, so that if the input or  $x$ -coordinate changes by an amount  $A$ , the output or  $y$ -coordinate changes by the amount  $m(A)$ . Students also use a linear equation to describe the association between two quantities in bivariate data (such as arm span vs. height for students in a classroom). At this grade, fitting the model, and assessing its fit to the data are done informally. Interpreting the model in the context of the data requires students to express a relationship between the two quantities in question and to interpret components of the relationship (such as slope and  $y$ -intercept) in terms of the situation.

Students strategically choose and efficiently implement procedures to solve linear equations in one variable, understanding that when they use the properties of equality and concept of logical equivalence, they maintain the solutions of the original equation. Students solve systems of two linear equations in two variables and relate the systems to pairs of lines in the plane; these intersect, are parallel, or are the same line. Students use linear equations, systems of linear equations, linear functions, and their understanding of slope of a line to analyze situations and solve problems.

4. Students grasp the concept of a function as a rule that assigns to each input exactly one output. They understand that functions describe situations where one quantity determines another. They can translate among representations and partial representations of functions (noting that tabular and graphical representations may be partial representations), and they describe how aspects of the function are reflected in the different representations.

- Students use ideas about distance and angles, how they behave under translations, rotations, reflections, and dilation, and ideas about congruence and similarity to describe and analyze two-dimensional figures and to solve problems. Students show that the sum of the angles in a triangle is the angle formed by a straight line, and that various configurations of lines give rise to similar triangles because of the angles created when a traversal cuts parallel lines. Students understand the statement of the Pythagorean Theorem and its converse, and can explain why the Pythagorean Theorem holds, for example, by decomposing a square in two different ways. They apply the Pythagorean Theorem to find distances between points on the coordinate plane, to find lengths, and to analyze polygons. Students complete their work on volume by solving problems involving cones, cylinders, and spheres.

**English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL’s need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

**COURSE STANDARDS**

| Name                           | Description  |
|--------------------------------|--|
| <a href="#">MAFS.7.EE.2.3:</a> | Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. <i>For example: If a woman making \$25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or \$2.50, for a new salary of \$27.50. If you want to place a towel bar 9 3/4 inches long in the center of a door that is 27 1/2 inches wide, you will need to place the bar about 9 inches</i> |

from each edge; this estimate can be used as a check on the exact computation.

**Remarks/Examples:  
Fluency Expectations or Examples of Culminating  
Standards**

Students solve multistep problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. This work is the culmination of many progressions of learning in arithmetic, problem solving and mathematical practices.

**Examples of Opportunities for In-Depth Focus**

This is a major capstone standard for arithmetic and its applications.

Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.

- a. Solve word problems leading to equations of the form  $px + q = r$  and  $p(x + q) = r$ , where  $p$ ,  $q$ , and  $r$  are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. *For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?*
- b. Solve word problems leading to inequalities of the form  $px + q > r$  or  $px + q < r$ , where  $p$ ,  $q$ , and  $r$  are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. *For example: As a salesperson, you are paid \$50 per week plus \$3 per sale. This week you want your pay to be at least \$100. Write an inequality for the number of sales you need to make, and describe the solutions.*

[MAFS.7.EE.2.4:](#)

**Remarks/Examples:  
Fluency Expectations or Examples of Culminating  
Standards**

In solving word problems leading to one-variable equations of

the form  $px + q = r$  and  $p(x + q) = r$ , students solve the equations fluently. This will require fluency with rational number arithmetic (7.NS.1.1–1.3), as well as fluency to some extent with applying properties operations to rewrite linear expressions with rational coefficients (7.EE.1.1).

**Examples of Opportunities for In-Depth Focus**

Work toward meeting this standard builds on the work that led to meeting 6.EE.2.7 and prepares students for the work that will lead to meeting 8.EE.3.7.

[MAFS.7.G.1.1:](#)

Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

[MAFS.7.G.1.2:](#)

Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.

[MAFS.7.G.1.3:](#)

Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.

[MAFS.7.G.2.4:](#)

Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.

[MAFS.7.G.2.5:](#)

Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure.

[MAFS.7.G.2.6:](#)

Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

**Remarks/Examples:**

**Examples of Opportunities for In-Depth Focus**

Work toward meeting this standard draws together grades 3–6 work with geometric measurement.

[MAFS.7.SP.1.1:](#)

Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that



random sampling tends to produce representative samples and support valid inferences.

[MAFS.7.SP.1.2:](#)

Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions. *For example, estimate the mean word length in a book by randomly sampling words from the book; predict the winner of a school election based on randomly sampled survey data. Gauge how far off the estimate or prediction might be.*

[MAFS.7.SP.2.3:](#)

Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability. *For example, the mean height of players on the basketball team is 10 cm greater than the mean height of players on the soccer team, about twice the variability (mean absolute deviation) on either team; on a dot plot, the separation between the two distributions of heights is noticeable.*

[MAFS.7.SP.2.4:](#)

Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations. *For example, decide whether the words in a chapter of a seventh-grade science book are generally longer than the words in a chapter of a fourth-grade science book.*

[MAFS.7.SP.3.5:](#)

Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.

[MAFS.7.SP.3.6:](#)

Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability. *For example, when rolling a number cube 600 times, predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times.*

[MAFS.7.SP.3.7:](#)

Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy.

- a. Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. *For example, if a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.*

- b. Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. *For example, find the approximate probability that a spinning penny will land heads up or that a tossed paper cup will land open-end down. Do the outcomes for the spinning penny appear to be equally likely based on the observed frequencies?*

[MAFS.7.SP.3.8:](#)

Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.

- a. Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.
- b. Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., “rolling double sixes”), identify the outcomes in the sample space which compose the event.
- c. Design and use a simulation to generate frequencies for compound events. *For example, use random digits as a simulation tool to approximate the answer to the question: If 40% of donors have type A blood, what is the probability that it will take at least 4 donors to find one with type A blood?*

[MAFS.8.NS.1.1:](#)

Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.

[MAFS.8.NS.1.2:](#)

Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g.,  $\pi^2$ ). *For example, by truncating the decimal expansion of  $\sqrt{2}$ , show that  $\sqrt{2}$  is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.*

[MAFS.8.EE.1.1:](#)

Know and apply the properties of integer exponents to generate equivalent numerical expressions. *For example,  $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$*

[MAFS.8.EE.1.2:](#)

Use square root and cube root symbols to represent solutions to equations of the form  $x^2 = p$  and  $x^3 = p$ , where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that  $\sqrt{2}$  is irrational.

[MAFS.8.EE.1.3:](#)

Use numbers expressed in the form of a single digit times an

integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. *For example, estimate the population of the United States as  $3 \times 10^8$  and the population of the world as  $7 \times 10^9$ , and determine that the world population is more than 20 times larger.*

[MAFS.8.EE.1.4:](#)

Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.

Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. *For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.*

[MAFS.8.EE.2.5:](#)

**Remarks/Examples:  
Examples of Opportunities for In-Depth Focus**

When students work toward meeting this standard, they build on grades 6–7 work with proportions and position themselves for grade 8 work with functions and the equation of a line.

[MAFS.8.EE.2.6:](#)

Use similar triangles to explain why the slope  $m$  is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation  $y = mx$  for a line through the origin and the equation  $y = mx + b$  for a line intercepting the vertical axis at  $b$ .

Solve linear equations in one variable.

[MAFS.8.EE.3.7:](#)

- a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form  $x = a$ ,  $a = a$ , or  $a = b$  results (where  $a$  and  $b$  are different numbers).
- b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.

**Remarks/Examples:**

### **Fluency Expectations or Examples of Culminating Standards**

Students have been working informally with one-variable linear equations since as early as kindergarten. This important line of development culminates in grade 8 with the solution of general one-variable linear equations, including cases with infinitely many solutions or no solutions as well as cases requiring algebraic manipulation using properties of operations. Coefficients and constants in these equations may be any rational numbers.

### **Examples of Opportunities for In-Depth Focus**

This is a culminating standard for solving one-variable linear equations.

Analyze and solve pairs of simultaneous linear equations.

- a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.
- b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. *For example,  $3x + 2y = 5$  and  $3x + 2y = 6$  have no solution because  $3x + 2y$  cannot simultaneously be 5 and 6.*
- c. Solve real-world and mathematical problems leading to two linear equations in two variables. *For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.*

[MAFS.8.EE.3.8:](#)

### **Remarks/Examples: Examples of Opportunities for In-Depth Focus**

When students work toward meeting this standard, they build on what they know about two-variable linear equations, and they enlarge the varieties of real-world and mathematical problems they can solve.

[MAFS.8.F.1.1:](#)

Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered

|                                      |   |
|--------------------------------------|---|
|                                      | <p>pairs consisting of an input and the corresponding output.</p>   |
| <p><a href="#">MAFS.8.F.1.2:</a></p> | <p>Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). <i>For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.</i></p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/> <b>Examples of Opportunities for In-Depth Focus</b></p> <p>Work toward meeting this standard repositions previous work with tables and graphs in the new context of input/output rules.</p> </div> |
| <p><a href="#">MAFS.8.F.1.3:</a></p> | <p>Interpret the equation <math>y = mx + b</math> as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. <i>For example, the function <math>A = s^2</math> giving the area of a square as a function of its side length is not linear because its graph contains the points <math>(1,1)</math>, <math>(2,4)</math> and <math>(3,9)</math>, which are not on a straight line.</i></p>  |
| <p><a href="#">MAFS.8.F.2.4:</a></p> | <p>Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two <math>(x, y)</math> values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.</p>   |
| <p><a href="#">MAFS.8.F.2.5:</a></p> | <p>Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.</p>  |
| <p><a href="#">MAFS.8.G.1.1:</a></p> | <p>Verify experimentally the properties of rotations, reflections, and translations:</p> <ol style="list-style-type: none"> <li>a. Lines are taken to lines, and line segments to line segments of the same length.</li> <li>b. Angles are taken to angles of the same measure.</li> <li>c. Parallel lines are taken to parallel lines.</li> </ol>  |
| <p><a href="#">MAFS.8.G.1.2:</a></p> | <p>Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures,</p>  |

|                               |   |
|-------------------------------|---|
|                               | describe a sequence that exhibits the congruence between them.  |
| <a href="#">MAFS.8.G.1.3:</a> | Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.  |
| <a href="#">MAFS.8.G.1.4:</a> | Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.   |
| <a href="#">MAFS.8.G.1.5:</a> | Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. <i>For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.</i>  |
| <a href="#">MAFS.8.G.2.6:</a> | Explain a proof of the Pythagorean Theorem and its converse.  |
| <a href="#">MAFS.8.G.2.7:</a> | <p>Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.</p> <div style="border: 1px solid black; padding: 10px; margin-top: 10px;"> <p><b>Remarks/Examples:<br/>Examples of Opportunities for In-Depth Focus</b></p> <p>The Pythagorean theorem is useful in practical problems, relates to grade-level work in irrational numbers and plays an important role mathematically in coordinate geometry in high school.</p> </div>  |
| <a href="#">MAFS.8.G.2.8:</a> | Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.   |
| <a href="#">MAFS.8.G.3.9:</a> | <p>Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.</p> <div style="border: 1px solid black; padding: 10px; margin-top: 10px;"> <p><b>Remarks/Examples:<br/>Fluency Expectations or Examples of Culminating Standards</b></p> <p>When students learn to solve problems involving volumes of cones, cylinders, and spheres — together with their previous grade 7 work in angle measure, area, surface area and volume (7.G.2.4–2.6) — they will have acquired a well-developed set of geometric measurement skills. These skills, along with proportional reasoning (7.RP) and multistep numerical problem solving (7.EE.2.3), can be combined and used in</p> </div> |

flexible ways as part of modeling during high school — not to mention after high school for college and careers.

[MAFS.8.SP.1.1:](#)

Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.

[MAFS.8.SP.1.2:](#)

Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.

[MAFS.8.SP.1.3:](#)

Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. *For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.*

[MAFS.8.SP.1.4:](#)

Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. *For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?*

[LAFS.7.SL.1.1:](#)

Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 7 topics, texts, and issues, building on others' ideas and expressing their own clearly.

- a. Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.
- b. Follow rules for collegial discussions, track progress toward specific goals and deadlines, and define individual roles as needed.
- c. Pose questions that elicit elaboration and respond to others' questions and comments with relevant observations and ideas that bring the discussion back on topic as needed.
- d. Acknowledge new information expressed by others and,

when warranted, modify their own views.

[LAFS.7.SL.1.2:](#)

Analyze the main ideas and supporting details presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how the ideas clarify a topic, text, or issue under study.

[LAFS.7.SL.1.3:](#)

Delineate a speaker's argument and specific claims, evaluating the soundness of the reasoning and the relevance and sufficiency of the evidence.

[LAFS.7.SL.2.4:](#)

Present claims and findings, emphasizing salient points in a focused, coherent manner with pertinent descriptions, facts, details, and examples; use appropriate eye contact, adequate volume, and clear pronunciation.

[LAFS.68.RST.1.3:](#)

Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

[LAFS.68.RST.2.4:](#)

Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.

[LAFS.68.RST.3.7:](#)

Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

[LAFS.68.WHST.1.1:](#)

Write arguments focused on *discipline-specific content*.

- a. Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.
- b. Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.
- c. Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.
- d. Establish and maintain a formal style.
- e. Provide a concluding statement or section that follows from and supports the argument presented.

[LAFS.68.WHST.2.4:](#)

Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

[MAFS.K12.MP.1.1:](#)

**Make sense of problems and persevere in solving them.**

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the



solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

**Reason abstractly and quantitatively.**

[MAFS.K12.MP.2.1:](#)

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

**Construct viable arguments and critique the reasoning of others.**

[MAFS.K12.MP.3.1:](#)

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which

the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

**Model with mathematics.**

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another.

[MAFS.K12.MP.4.1:](#)

Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

**Use appropriate tools strategically.**

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically

[MAFS.K12.MP.5.1:](#)

using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

**Attend to precision.**

[MAFS.K12.MP.6.1:](#)

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

**Look for and make use of structure.**

[MAFS.K12.MP.7.1:](#)

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

**Look for and express regularity in repeated reasoning.**

[MAFS.K12.MP.8.1:](#)

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts.

Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.AC.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.

## M/J Grade 8 Pre-Algebra (#1205070)

**Version for Academic Year:** 2015 - 2016

**Course Number:** 1205070

**Abbreviated Title:** M/J GRADE 8 PRE-ALG

**Course Length:** Year (Y)

**Course Type:** Core

**Course Level:** 2

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 6,7,8

### GENERAL NOTES

Additional content addressed on the Grade 8 NAEP Mathematics assessment includes:

- Draw or sketch from a written description polygons, circles, or semicircles. ([MAFS.7.G.1.2](#); include circles and semicircles)
- Represent or describe a three-dimensional situation in a two-dimensional drawing from different views. ([MAFS.6.G.1.4](#))
- Demonstrate an understanding about the two- and three-dimensional shapes in our world through identifying, drawing, modeling, building, or taking apart. ([MAFS.6.G.1.4](#), [MAFS.7.G.1.3](#), [MAFS.7.G.2.6](#))
- Visualize or describe the cross section of a solid. ([MAFS.7.G.1.3](#))
- Represent geometric figures using rectangular coordinates on a plane. ([MAFS.6.G.1.3](#))
- Describe how mean, median, mode, range, or interquartile ranges relate to distribution shape. (MAFS.6.SP.2.5c)
- Using appropriate statistical measures, compare two or more data sets describing the same characteristic for two different populations for subset of the same population. ([MAFS.7.SP.2.3](#), [MAFS.7.SP.2.4](#))
- Given a sample, identify possible sources of bias in sampling. ([MAFS.7.SP.1.1](#))
- Distinguish between a random and nonrandom sample. ([MAFS.7.SP.1.1](#))
- Evaluate the design of an experiment. ([MAFS.7.SP.1.2](#))
- Determine the theoretical probability of simple and compound events in familiar contexts. (MAFS.7.SP.3.8a)
- Estimate the probability of simple and compound events through experimentation or simulation. ([MAFS.7.SP.3.8](#))
- Use theoretical probability to evaluate or predict experimental outcomes. ([MAFS.7.SP.3.6](#), MAFS.SP.3.7)
- Describe relative positions of points and lines using the geometric ideas of midpoint, points on common line through a common point, parallelism, or perpendicularity.
- Describe the intersection of two or more geometric figures in the plane (e.g., intersection of a circle and a line).
- Make and test a geometric conjecture about regular polygons.

### **English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

### **VERSION REQUIREMENTS**

In Grade 8, instructional time should focus on three critical areas: (1) formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations; (2) grasping the concept of a function and using functions to describe quantitative relationships; (3) analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem.

1. Students use linear equations and systems of linear equations to represent, analyze, and solve a variety of problems. Students recognize equations for proportions ( $y/x = m$  or  $y = mx$ ) as special linear equations ( $y = mx + b$ ), understanding that the constant of proportionality ( $m$ ) is the slope, and the graphs are lines through the origin. They understand that the slope ( $m$ ) of a line is a constant rate of change, so that if the input or  $x$ -coordinate changes by an amount  $A$ , the output or  $y$ -coordinate changes by the amount  $m(A)$ . Students also use a linear equation to describe the association between two quantities in bivariate data (such as arm span vs. height for students in a classroom). At this grade, fitting the model, and assessing its fit to the data are done informally. Interpreting the model in the context of the data requires students to express a relationship between the two quantities in question and to interpret components of the relationship (such as slope and  $y$ -intercept) in terms of the situation.

Students strategically choose and efficiently implement procedures to solve linear equations in one variable, understanding that when they use the properties of equality and concept of logical equivalence, they maintain the solutions of the original equation. Students solve systems of two linear equations in two variables and relate the systems to pairs of lines in the plane; these intersect, are parallel, or are the same line. Students use linear equations, systems of linear equations, linear functions, and their understanding of slope of a line to analyze situations and solve problems.

2. Students grasp the concept of a function as a rule that assigns to each input exactly one output. They understand that functions describe situations where one quantity determines another. They can translate among representations and partial representations of functions (noting that tabular and graphical representations may be partial representations), and they describe how aspects of the function are reflected in the different representations.
  
3. Students use ideas about distance and angles, how they behave under translations, rotations, reflections, and dilation, and ideas about congruence and similarity to describe and analyze two-dimensional figures and to solve problems. Students show that the sum of the angles in a triangle is the angle formed by a straight line, and that various configurations of lines give rise to similar triangles because of the angles created when a traversal cuts parallel lines. Students understand the statement of the Pythagorean Theorem and its converse, and can explain why the Pythagorean Theorem holds, for example, by decomposing a square in two different ways. They apply the Pythagorean Theorem to find distances between points on the coordinate plane, to find lengths, and to analyze polygons. Students complete their work on volume by solving problems involving cones, cylinders, and spheres.

## COURSE STANDARDS

| Name                           | Description   |
|--------------------------------|---|
| <a href="#">MAFS.8.NS.1.1:</a> | Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.   |
| <a href="#">MAFS.8.NS.1.2:</a> | Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., $\pi^2$ ). <i>For example, by truncating the decimal expansion of <math>\sqrt{2}</math>, show that <math>\sqrt{2}</math> is between 1 and 2, then between 1.4 and 1.5, and explain how to</i> |

|                                |  |
|--------------------------------|--|
|                                | <i>continue on to get better approximations.</i>   |
| <a href="#">MAFS.8.EE.1.1:</a> | Know and apply the properties of integer exponents to generate equivalent numerical expressions. <i>For example, <math>3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27</math></i>  |
| <a href="#">MAFS.8.EE.1.2:</a> | Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$ , where $p$ is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.   |
| <a href="#">MAFS.8.EE.1.3:</a> | Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. <i>For example, estimate the population of the United States as <math>3 \times 10^8</math> and the population of the world as <math>7 \times 10^9</math>, and determine that the world population is more than 20 times larger.</i> |
| <a href="#">MAFS.8.EE.1.4:</a> | Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.                                       |
|                                | Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. <i>For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.</i>  |
| <a href="#">MAFS.8.EE.2.5:</a> | <div style="border: 1px solid black; padding: 10px;"> <p><b>Remarks/Examples:</b><br/> <b>Examples of Opportunities for In-Depth Focus</b></p> <p>When students work toward meeting this standard, they build on grades 6–7 work with proportions and position themselves for grade 8 work with functions and the equation of a line.</p> </div>   |
| <a href="#">MAFS.8.EE.2.6:</a> | Use similar triangles to explain why the slope $m$ is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at $b$ .   |
|                                | Solve linear equations in one variable.  |
| <a href="#">MAFS.8.EE.3.7:</a> | <ol style="list-style-type: none"> <li>a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an</li> </ol>   |



equivalent equation of the form  $x = a$ ,  $a = a$ , or  $a = b$  results (where  $a$  and  $b$  are different numbers).

- b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.

**Remarks/Examples:**

**Fluency Expectations or Examples of Culminating Standards**

Students have been working informally with one-variable linear equations since as early as kindergarten. This important line of development culminates in grade 8 with the solution of general one-variable linear equations, including cases with infinitely many solutions or no solutions as well as cases requiring algebraic manipulation using properties of operations. Coefficients and constants in these equations may be any rational numbers.

**Examples of Opportunities for In-Depth Focus**

This is a culminating standard for solving one-variable linear equations.

Analyze and solve pairs of simultaneous linear equations.

- a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.
- b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. *For example,  $3x + 2y = 5$  and  $3x + 2y = 6$  have no solution because  $3x + 2y$  cannot simultaneously be 5 and 6.*
- c. Solve real-world and mathematical problems leading to two linear equations in two variables. *For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.*

[MAFS.8.EE.3.8:](#)

**Remarks/Examples:**

|                                      |   |
|--------------------------------------|---|
|                                      | <p><b>Examples of Opportunities for In-Depth Focus</b></p> <p>When students work toward meeting this standard, they build on what they know about two-variable linear equations, and they enlarge the varieties of real-world and mathematical problems they can solve.</p>   |
| <p><a href="#">MAFS.8.F.1.1:</a></p> | <p>Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.</p>   |
| <p><a href="#">MAFS.8.F.1.2:</a></p> | <p>Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). <i>For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.</i></p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:<br/>Examples of Opportunities for In-Depth Focus</b></p> <p>Work toward meeting this standard repositions previous work with tables and graphs in the new context of input/output rules.</p> </div> |
| <p><a href="#">MAFS.8.F.1.3:</a></p> | <p>Interpret the equation <math>y = mx + b</math> as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. <i>For example, the function <math>A = s^2</math> giving the area of a square as a function of its side length is not linear because its graph contains the points <math>(1,1)</math>, <math>(2,4)</math> and <math>(3,9)</math>, which are not on a straight line.</i></p>  |
| <p><a href="#">MAFS.8.F.2.4:</a></p> | <p>Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two <math>(x, y)</math> values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.</p>   |
| <p><a href="#">MAFS.8.F.2.5:</a></p> | <p>Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.</p>  |
| <p><a href="#">MAFS.8.G.1.1:</a></p> | <p>Verify experimentally the properties of rotations, reflections, and translations:</p>  |

|                               |  |
|-------------------------------|--|
|                               | <ul style="list-style-type: none"> <li>a. Lines are taken to lines, and line segments to line segments of the same length.</li> <li>b. Angles are taken to angles of the same measure.</li> <li>c. Parallel lines are taken to parallel lines.</li> </ul>  |
| <a href="#">MAFS.8.G.1.2:</a> | Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.   |
| <a href="#">MAFS.8.G.1.3:</a> | Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.   |
| <a href="#">MAFS.8.G.1.4:</a> | Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.  |
| <a href="#">MAFS.8.G.1.5:</a> | Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. <i>For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.</i>   |
| <a href="#">MAFS.8.G.2.6:</a> | Explain a proof of the Pythagorean Theorem and its converse.   |
| <a href="#">MAFS.8.G.2.7:</a> | <p>Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.</p> <div style="border: 1px solid black; padding: 10px;"> <p><b>Remarks/Examples:</b><br/> <b>Examples of Opportunities for In-Depth Focus</b></p> <p>The Pythagorean theorem is useful in practical problems, relates to grade-level work in irrational numbers and plays an important role mathematically in coordinate geometry in high school.</p> </div> |
| <a href="#">MAFS.8.G.2.8:</a> | Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.  |
| <a href="#">MAFS.8.G.3.9:</a> | <p>Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.</p> <div style="border: 1px solid black; padding: 10px;"> <p><b>Remarks/Examples:</b><br/> <b>Fluency Expectations or Examples of Culminating</b></p> </div>   |

## Standards

When students learn to solve problems involving volumes of cones, cylinders, and spheres — together with their previous grade 7 work in angle measure, area, surface area and volume (7.G.2.4–2.6) — they will have acquired a well-developed set of geometric measurement skills. These skills, along with proportional reasoning (7.RP) and multistep numerical problem solving (7.EE.2.3), can be combined and used in flexible ways as part of modeling during high school — not to mention after high school for college and careers.

[MAFS.8.SP.1.1:](#)

Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.

[MAFS.8.SP.1.2:](#)

Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.

[MAFS.8.SP.1.3:](#)

Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. *For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.*

[MAFS.8.SP.1.4:](#)

Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. *For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?*

[LAFS.8.SL.1.1:](#)

Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly.

- a. Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe

|                                   |  |
|-----------------------------------|--|
|                                   | <p>and reflect on ideas under discussion.</p> <ol style="list-style-type: none"> <li>b. Follow rules for collegial discussions and decision-making, track progress toward specific goals and deadlines, and define individual roles as needed.</li> <li>c. Pose questions that connect the ideas of several speakers and respond to others' questions and comments with relevant evidence, observations, and ideas.</li> <li>d. Acknowledge new information expressed by others, and, when warranted, qualify or justify their own views in light of the evidence presented.</li> </ol>  |
| <a href="#">LAFS.8.SL.1.2:</a>    | Analyze the purpose of information presented in diverse media and formats (e.g., visually, quantitatively, orally) and evaluate the motives (e.g., social, commercial, political) behind its presentation.   |
| <a href="#">LAFS.8.SL.1.3:</a>    | Delineate a speaker's argument and specific claims, evaluating the soundness of the reasoning and relevance and sufficiency of the evidence and identifying when irrelevant evidence is introduced.  |
| <a href="#">LAFS.8.SL.2.4:</a>    | Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.   |
| <a href="#">LAFS.68.RST.1.3:</a>  | Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.  |
| <a href="#">LAFS.68.RST.2.4:</a>  | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.   |
| <a href="#">LAFS.68.RST.3.7:</a>  | Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).  |
| <a href="#">LAFS.68.WHST.1.1:</a> | <p>Write arguments focused on <i>discipline-specific content</i>.</p> <ol style="list-style-type: none"> <li>a. Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.</li> <li>b. Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.</li> <li>c. Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.</li> <li>d. Establish and maintain a formal style.</li> <li>e. Provide a concluding statement or section that follows from and supports the argument presented.</li> </ol> |

[LAFS.68.WHST.2.4:](#)

Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

[MAFS.K12.MP.1.1:](#)

**Make sense of problems and persevere in solving them.**

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

[MAFS.K12.MP.2.1:](#)

**Reason abstractly and quantitatively.**

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

[MAFS.K12.MP.3.1:](#)

**Construct viable arguments and critique the reasoning of**

**others.**

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

**Model with mathematics.**

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another.

[MAFS.K12.MP.4.1:](#)

Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

[MAFS.K12.MP.5.1:](#)

**Use appropriate tools strategically.**

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

**Attend to precision.**

[MAFS.K12.MP.6.1:](#)

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

**Look for and make use of structure.**

[MAFS.K12.MP.7.1:](#)

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems.



They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

**Look for and express regularity in repeated reasoning.**

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through  $(1, 2)$  with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

[MAFS.K12.MP.8.1:](#)

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.AC.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.

## **Informal Geometry (#1206300)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 1206300

**Abbreviated Title:** INF GEO

**Course Length:** Year (Y)

**Course Type:** Core

**Course Level:** 2

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 9,10,11,12

### **VERSION DESCRIPTION**

The fundamental purpose of the course in Informal Geometry is to extend students' geometric experiences from the middle grades. Students explore more complex geometric situations and deepen their explanations of geometric relationships. Important differences exist between this Geometry course and the historical approach taken in Geometry classes. For example, transformations are emphasized early in this course. Close attention should be paid to the introductory content for the Geometry conceptual category found in the high school standards. The Standards for Mathematical Practice apply throughout each course and, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations. The critical areas, organized into five units are as follows.

**Unit 1- Congruence, Proof, and Constructions:** In previous grades, students were asked to draw triangles based on given measurements. They also have prior experience with rigid motions: translations, reflections, and rotations and have used these to develop notions about what it means for two objects to be congruent. In this unit, students establish triangle congruence criteria, based on analyses of rigid motions and formal constructions. Students informally prove theorems—using a variety of formats—and solve problems about triangles, quadrilaterals, and other polygons. They apply reasoning to complete geometric constructions and explain why they work.

**Unit 2- Similarity, Proof, and Trigonometry:** Students apply their earlier experience with dilations and proportional reasoning to build a formal understanding of similarity. They identify criteria for similarity of triangles, use similarity to solve problems, and apply similarity in right triangles, with particular attention to special right triangles and the Pythagorean theorem.

**Unit 3- Extending to Three Dimensions:** Students' experience with two-dimensional and three-dimensional objects is extended to include informal explanations of circumference, area and volume formulas.

**Unit 4- Connecting Algebra and Geometry Through Coordinates:** Building on their

work with the Pythagorean theorem in 8th grade to find distances, students use a rectangular coordinate system to verify geometric relationships, including properties of special triangles and quadrilaterals and slopes of parallel and perpendicular lines, which relates back to work done in the first course.

**Unit 5- Circles With and Without Coordinates:** In this unit students study the Cartesian coordinate system and use the distance formula to write the equation of a circle when given the radius and the coordinates of its center. Given an equation of a circle, they draw the graph in the coordinate plane, and apply techniques for solving quadratic equations, which relates back to work done in the first course, to determine intersections between lines and circles or parabolas.

## GENERAL NOTES

**Important Note:** This Informal Geometry course content does not align with the End-of-Course Assessment required for graduation.

### English Language Development ELD Standards Special Notes Section:

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

## COURSE STANDARDS

| Name                               | Description  |
|------------------------------------|--|
| <a href="#">MAFS.912.G-CO.1.1:</a> | Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.  |
| <a href="#">MAFS.912.G-CO.1.2:</a> | Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch). |

|                                     |   |
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| <a href="#">MAFS.912.G-CO.1.3:</a>  | Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.  |
| <a href="#">MAFS.912.G-CO.1.4:</a>  | Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.  |
| <a href="#">MAFS.912.G-CO.1.5:</a>  | Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.  |
| <a href="#">MAFS.912.G-CO.2.6:</a>  | Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.  |
| <a href="#">MAFS.912.G-CO.2.7:</a>  | Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.  |
| <a href="#">MAFS.912.G-CO.2.8:</a>  | Explain how the criteria for triangle congruence (ASA, SAS, SSS, and Hypotenuse-Leg) follow from the definition of congruence in terms of rigid motions.  |
| <a href="#">MAFS.912.G-SRT.1.1:</a> | <p>Verify experimentally the properties of dilations given by a center and a scale factor:</p> <ol style="list-style-type: none"> <li>a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.</li> <li>b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.</li> </ol>                    |
| <a href="#">MAFS.912.G-SRT.1.2:</a> | Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.  |
| <a href="#">MAFS.912.G-SRT.1.3:</a> | Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.   |
| <a href="#">MAFS.912.G-SRT.2.5:</a> | <p>Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.</p> <div style="border: 1px solid black; padding: 10px; margin-top: 10px;"> <p><b>Remarks/Examples:</b><br/> <b>Geometry - Fluency Recommendations</b></p> <p>Fluency with the triangle congruence and similarity criteria will help students throughout their investigations of triangles,</p> </div> |

|                                     |  |
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|                                     | <p>quadrilaterals, circles, parallelism, and trigonometric ratios. These criteria are necessary tools in many geometric modeling tasks.</p>  |
| <a href="#">MAFS.912.G-C.1.1:</a>   | Prove that all circles are similar.  |
| <a href="#">MAFS.912.G-C.1.2:</a>   | Identify and describe relationships among inscribed angles, radii, and chords. <i>Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.</i>                           |
|                                     | Use coordinates to prove simple geometric theorems algebraically. <i>For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point <math>(1, \sqrt{3})</math> lies on the circle centered at the origin and containing the point <math>(0, 2)</math>.</i> |
| <a href="#">MAFS.912.G-GPE.2.4:</a> | <p><b>Remarks/Examples:</b><br/> <b>Geometry - Fluency Recommendations</b></p> <p>Fluency with the use of coordinates to establish geometric results, calculate length and angle, and use geometric representations as a modeling tool are some of the most valuable tools in mathematics and related fields.</p>                              |
| <a href="#">MAFS.912.G-GPE.2.6:</a> | Find the point on a directed line segment between two given points that partitions the segment in a given ratio.   |
|                                     | Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula. ★   |
| <a href="#">MAFS.912.G-GPE.2.7:</a> | <p><b>Remarks/Examples:</b><br/> <b>Geometry - Fluency Recommendations</b></p> <p>Fluency with the use of coordinates to establish geometric results, calculate length and angle, and use geometric representations as a modeling tool are some of the most valuable tools in mathematics and related fields.</p>                              |
| <a href="#">MAFS.912.G-GMD.1.1:</a> | Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. <i>Use dissection arguments, Cavalieri's principle, and informal limit arguments.</i>   |
| <a href="#">MAFS.912.G-GMD.1.3:</a> | Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. ★   |
| <a href="#">MAFS.912.G-</a>         | Identify the shapes of two-dimensional cross-sections of three-  |

|                                    |   |
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| <a href="#">GMD.2.4:</a>           | dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.  |
| <a href="#">MAFS.912.G-MG.1.1:</a> | Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). ★  |
| <a href="#">MAFS.912.G-MG.1.2:</a> | Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). ★   |
| <a href="#">MAFS.912.G-MG.1.3:</a> | Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios). ★  |
| <a href="#">LAFS.910.SL.1.1:</a>   | <p>Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.</p> <ol style="list-style-type: none"> <li>Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.</li> <li>Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed.</li> <li>Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.</li> <li>Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.</li> </ol> |
| <a href="#">LAFS.910.SL.1.2:</a>   | Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.  |
| <a href="#">LAFS.910.SL.1.3:</a>   | Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.   |
| <a href="#">LAFS.910.SL.2.4:</a>   | Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of   |

|                                    |  |
|------------------------------------|--|
|                                    | reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.  |
| <a href="#">LAFS.910.RST.1.3:</a>  | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.  |
| <a href="#">LAFS.910.RST.2.4:</a>  | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.  |
| <a href="#">LAFS.910.RST.3.7:</a>  | Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.   |
| <a href="#">LAFS.910.WHST.1.1:</a> | <p>Write arguments focused on <i>discipline-specific content</i>.</p> <ol style="list-style-type: none"> <li>Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.</li> <li>Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience’s knowledge level and concerns.</li> <li>Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.</li> <li>Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.</li> <li>Provide a concluding statement or section that follows from or supports the argument presented.</li> </ol> |
| <a href="#">LAFS.910.WHST.2.4:</a> | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.   |
| <a href="#">LAFS.910.WHST.3.9:</a> | Draw evidence from informational texts to support analysis, reflection, and research.  |
| <a href="#">MAFS.K12.MP.1.1:</a>   | <p><b>Make sense of problems and persevere in solving them.</b></p> <p>Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping</p>   |

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[MAFS.K12.MP.2.1:](#)

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[MAFS.K12.MP.3.1:](#)

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students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

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[MAFS.K12.MP.4.1:](#)

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[MAFS.K12.MP.5.1:](#)

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[MAFS.K12.MP.6.1:](#)

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[MAFS.K12.MP.7.1:](#)

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

**Look for and express regularity in repeated reasoning.**

[MAFS.K12.MP.8.1:](#)

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11

that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.AC.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.

## **Geometry (#1206310)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 1206310

**Abbreviated Title:** GEO

**Number of Credits:** One credit (1)

**Course Length:** Year (Y)

**Course Type:** Core

**Course Level:** 2

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 9,10,11,12

### **VERSION DESCRIPTION**

The fundamental purpose of the course in Geometry is to formalize and extend students' geometric experiences from the middle grades. Students explore more complex geometric situations and deepen their explanations of geometric relationships, moving towards formal mathematical arguments. Important differences exist between this Geometry course and the historical approach taken in Geometry classes. For example, transformations are emphasized early in this course. Close attention should be paid to the introductory content for the Geometry conceptual category found in the high school standards. The Standards for Mathematical Practice apply throughout each course and, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations. The critical areas, organized into five units are as follows.

**Unit 1-Congruence, Proof, and Constructions:** In previous grades, students were asked to draw triangles based on given measurements. They also have prior experience with rigid motions: translations, reflections, and rotations and have used these to develop notions about what it means for two objects to be congruent. In this unit, students establish triangle congruence criteria, based on analyses of rigid motions and formal constructions. They use triangle congruence as a familiar foundation for the development of formal proof. Students prove theorems using a variety of formats and solve problems about triangles, quadrilaterals, and other polygons. They apply reasoning to complete geometric constructions and explain why they work.

**Unit 2- Similarity, Proof, and Trigonometry:** Students apply their earlier experience with dilation and proportional reasoning to build a formal understanding of similarity. They identify criteria for similarity of triangles, use similarity to solve problems, and apply similarity in right triangles to understand right triangle trigonometry, with particular attention to special right triangles and the Pythagorean theorem. Students develop the Laws of Sines and Cosines in order to find missing measures of general (not necessarily right) triangles, building on students work with quadratic equations done in

the first course. They are able to distinguish whether three given measures (angles or sides) define 0, 1, 2, or infinitely many triangles.

**Unit 3- Extending to Three Dimensions:** Students' experience with two-dimensional and three-dimensional objects is extended to include informal explanations of circumference, area and volume formulas. Additionally, students apply their knowledge of two-dimensional shapes to consider the shapes of cross-sections and the result of rotating a two-dimensional object about a line.

**Unit 4- Connecting Algebra and Geometry Through Coordinates:** Building on their work with the Pythagorean theorem in 8th grade to find distances, students use a rectangular coordinate system to verify geometric relationships, including properties of special triangles and quadrilaterals and slopes of parallel and perpendicular lines, which relates back to work done in the first course. Students continue their study of quadratics by connecting the geometric and algebraic definitions of the parabola.

**Unit 5-Circles With and Without Coordinates:** In this unit students prove basic theorems about circles, such as a tangent line is perpendicular to a radius, inscribed angle theorem, and theorems about chords, secants, and tangents dealing with segment lengths and angle measures. They study relationships among segments on chords, secants, and tangents as an application of similarity. In the Cartesian coordinate system, students use the distance formula to write the equation of a circle when given the radius and the coordinates of its center. Given an equation of a circle, they draw the graph in the coordinate plane, and apply techniques for solving quadratic equations, which relates back to work done in the first course, to determine intersections between lines and circles or parabolas and between two circles.

## **GENERAL NOTES**

### **English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access

an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

## COURSE STANDARDS

| Name                               | Description  |
|------------------------------------|--|
| <a href="#">MAFS.912.G-CO.1.1:</a> | Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.  |
| <a href="#">MAFS.912.G-CO.1.2:</a> | Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch). |
| <a href="#">MAFS.912.G-CO.1.3:</a> | Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.   |
| <a href="#">MAFS.912.G-CO.1.4:</a> | Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.   |
| <a href="#">MAFS.912.G-CO.1.5:</a> | Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.   |
| <a href="#">MAFS.912.G-CO.2.6:</a> | Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.   |
| <a href="#">MAFS.912.G-CO.2.7:</a> | Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.   |
| <a href="#">MAFS.912.G-CO.2.8:</a> | Explain how the criteria for triangle congruence (ASA, SAS, SSS, and Hypotenuse-Leg) follow from the definition of congruence in terms of rigid motions.   |
| <a href="#">MAFS.912.G-CO.3.9:</a> | Prove theorems about lines and angles; use theorems about lines and angles to solve problems. <i>Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line</i>          |

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|  | <i>segment are exactly those equidistant from the segment's endpoints.</i>  |
| <a href="#"><u>MAFS.912.G-CO.3.10:</u></a> | Prove theorems about triangles; use theorems about triangles to solve problems. <i>Theorems include: measures of interior angles of a triangle sum to <math>180^\circ</math>; triangle inequality theorem; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.</i>   |
| <a href="#"><u>MAFS.912.G-CO.3.11:</u></a> | Prove theorems about parallelograms; use theorems about parallelograms to solve problems. <i>Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.</i>   |
| <a href="#"><u>MAFS.912.G-CO.4.12:</u></a> | <p>Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). <i>Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.</i></p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/> <b>Geometry - Fluency Recommendations</b></p> <p>Fluency with the use of construction tools, physical and computational, helps students draft a model of a geometric phenomenon and can lead to conjectures and proofs.</p> </div> |
| <a href="#"><u>MAFS.912.G-CO.4.13:</u></a> | Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.   |
| <a href="#"><u>MAFS.912.G-SRT.1.1:</u></a> | <p>Verify experimentally the properties of dilations given by a center and a scale factor:</p> <ol style="list-style-type: none"> <li>a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.</li> <li>b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.</li> </ol>  |
| <a href="#"><u>MAFS.912.G-SRT.1.2:</u></a> | Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.  |

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| <a href="#">MAFS.912.G-SRT.1.3:</a> | Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.  |
| <a href="#">MAFS.912.G-SRT.2.4:</a> | Prove theorems about triangles. <i>Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.</i>   |
| <a href="#">MAFS.912.G-SRT.2.5:</a> | Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.<br><br><b>Remarks/Examples:<br/>Geometry - Fluency Recommendations</b><br><br>Fluency with the triangle congruence and similarity criteria will help students throughout their investigations of triangles, quadrilaterals, circles, parallelism, and trigonometric ratios. These criteria are necessary tools in many geometric modeling tasks. |
| <a href="#">MAFS.912.G-SRT.3.6:</a> | Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.   |
| <a href="#">MAFS.912.G-SRT.3.7:</a> | Explain and use the relationship between the sine and cosine of complementary angles.  |
| <a href="#">MAFS.912.G-SRT.3.8:</a> | Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. ★   |
| <a href="#">MAFS.912.G-C.1.1:</a>   | Prove that all circles are similar.  |
| <a href="#">MAFS.912.G-C.1.2:</a>   | Identify and describe relationships among inscribed angles, radii, and chords. <i>Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.</i>   |
| <a href="#">MAFS.912.G-C.1.3:</a>   | Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.   |
| <a href="#">MAFS.912.G-C.2.5:</a>   | Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.   |
| <a href="#">MAFS.912.G-GPE.1.1:</a> | Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.  |
| <a href="#">MAFS.912.G-GPE.2.4:</a> | Use coordinates to prove simple geometric theorems algebraically. <i>For example, prove or disprove that a figure</i>  |



defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point  $(1, \sqrt{3})$  lies on the circle centered at the origin and containing the point  $(0, 2)$ .

**Remarks/Examples:**  
**Geometry - Fluency Recommendations**

Fluency with the use of coordinates to establish geometric results, calculate length and angle, and use geometric representations as a modeling tool are some of the most valuable tools in mathematics and related fields.

Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).

[MAFS.912.G-GPE.2.5:](#)

**Remarks/Examples:**  
**Geometry - Fluency Recommendations**

Fluency with the use of coordinates to establish geometric results, calculate length and angle, and use geometric representations as a modeling tool are some of the most valuable tools in mathematics and related fields.

[MAFS.912.G-GPE.2.6:](#)

Find the point on a directed line segment between two given points that partitions the segment in a given ratio.

Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula. ★

[MAFS.912.G-GPE.2.7:](#)

**Remarks/Examples:**  
**Geometry - Fluency Recommendations**

Fluency with the use of coordinates to establish geometric results, calculate length and angle, and use geometric representations as a modeling tool are some of the most valuable tools in mathematics and related fields.

[MAFS.912.G-GMD.1.1:](#)

Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. *Use dissection arguments, Cavalieri's principle, and informal limit arguments.*

[MAFS.912.G-GMD.1.3:](#)

Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. ★

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| <a href="#">MAFS.912.G-GMD.2.4:</a> | Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.   |
| <a href="#">MAFS.912.G-MG.1.1:</a>  | Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). ★  |
| <a href="#">MAFS.912.G-MG.1.2:</a>  | Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). ★   |
| <a href="#">MAFS.912.G-MG.1.3:</a>  | Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios). ★  |
| <a href="#">LAFS.910.SL.1.1:</a>    | <p>Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.</p> <ol style="list-style-type: none"> <li>Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.</li> <li>Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed.</li> <li>Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.</li> <li>Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.</li> </ol> |
| <a href="#">LAFS.910.SL.1.2:</a>    | Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.  |
| <a href="#">LAFS.910.SL.1.3:</a>    | Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.   |
| <a href="#">LAFS.910.SL.2.4:</a>    | Present information, findings, and supporting evidence clearly,   |

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|                                    | <p>concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.</p>  |
| <a href="#">LAFS.910.RST.1.3:</a>  | <p>Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.</p>  |
| <a href="#">LAFS.910.RST.2.4:</a>  | <p>Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.</p>  |
| <a href="#">LAFS.910.RST.3.7:</a>  | <p>Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.</p>   |
| <a href="#">LAFS.910.WHST.1.1:</a> | <p>Write arguments focused on <i>discipline-specific content</i>.</p> <ol style="list-style-type: none"> <li>a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.</li> <li>b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience’s knowledge level and concerns.</li> <li>c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.</li> <li>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.</li> <li>e. Provide a concluding statement or section that follows from or supports the argument presented.</li> </ol> |
| <a href="#">LAFS.910.WHST.2.4:</a> | <p>Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.</p>   |
| <a href="#">LAFS.910.WHST.3.9:</a> | <p>Draw evidence from informational texts to support analysis, reflection, and research.</p>  |
| <a href="#">MAFS.K12.MP.1.1:</a>   | <p><b>Make sense of problems and persevere in solving them.</b></p> <p>Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the</p>  |

solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

**Reason abstractly and quantitatively.**

[MAFS.K12.MP.2.1:](#)

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

**Construct viable arguments and critique the reasoning of others.**

[MAFS.K12.MP.3.1:](#)

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the

context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

**Model with mathematics.**

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another.

[MAFS.K12.MP.4.1:](#)

Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

**Use appropriate tools strategically.**

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors

[MAFS.K12.MP.5.1:](#)

by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

**Attend to precision.**

[MAFS.K12.MP.6.1:](#)

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

**Look for and make use of structure.**

[MAFS.K12.MP.7.1:](#)

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

**Look for and express regularity in repeated reasoning.**

[MAFS.K12.MP.8.1:](#)

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts.

|   |   |
|---|---|
|   | <p>Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation <math>(y - 2)/(x - 1) = 3</math>. Noticing the regularity in the way terms cancel when expanding <math>(x - 1)(x + 1)</math>, <math>(x - 1)(x^2 + x + 1)</math>, and <math>(x - 1)(x^3 + x^2 + x + 1)</math> might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.</p> |
| <p><a href="#"><u>ELD.K12.ELL.1.1:</u></a></p>  | <p>English language learners communicate for social and instructional purposes within the school setting.</p>   |
| <p><a href="#"><u>ELD.K12.ELL.AC.1:</u></a></p> | <p>English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.</p>   |

## **Geometry Honors (#1206320)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 1206320

**Abbreviated Title:** GEO HON

**Number of Credits:** One credit (1)

**Course Length:** Year (Y)

**Honors?** Yes

**Course Type:** Core

**Course Level:** 3

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 9,10,11,12

### **VERSION DESCRIPTION**

The fundamental purpose of the course in Geometry is to formalize and extend students' geometric experiences from the middle grades. Students explore more complex geometric situations and deepen their explanations of geometric relationships, moving towards formal mathematical arguments. Important differences exist between this Geometry course and the historical approach taken in Geometry classes. For example, transformations are emphasized early in this course. Close attention should be paid to the introductory content for the Geometry conceptual category found in the high school standards. The Standards for Mathematical Practice apply throughout each course and, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations. The critical areas, organized into five units are as follows.

**Unit 1- Congruence, Proof, and Constructions:** In previous grades, students were asked to draw triangles based on given measurements. They also have prior experience with rigid motions: translations, reflections, and rotations and have used these to develop notions about what it means for two objects to be congruent. In this unit, students establish triangle congruence criteria, based on analyses of rigid motions and formal constructions. They use triangle congruence as a familiar foundation for the development of formal proof. Students prove theorems using a variety of formats and solve problems about triangles, quadrilaterals, and other polygons. They apply reasoning to complete geometric constructions and explain why they work.

**Unit 2- Similarity, Proof, and Trigonometry:** Students apply their earlier experience with dilation and proportional reasoning to build a formal understanding of similarity. They identify criteria for similarity of triangles, use similarity to solve problems, and apply similarity in right triangles to understand right triangle trigonometry, with particular attention to special right triangles and the Pythagorean theorem. Students develop the Laws of Sines and Cosines in order to find missing measures of general (not



necessarily right) triangles, building on students work with quadratic equations done in the first course. They are able to distinguish whether three given measures (angles or sides) define 0, 1, 2, or infinitely many triangles.

**Unit 3- Extending to Three Dimensions:** Students' experience with two-dimensional and three-dimensional objects is extended to include informal explanations of circumference, area and volume formulas. Additionally, students apply their knowledge of two-dimensional shapes to consider the shapes of cross-sections and the result of rotating a two-dimensional object about a line.

**Unit 4- Connecting Algebra and Geometry Through Coordinates:** Building on their work with the Pythagorean theorem in 8th grade to find distances, students use a rectangular coordinate system to verify geometric relationships, including properties of special triangles and quadrilaterals and slopes of parallel and perpendicular lines, which relates back to work done in the first course. Students continue their study of quadratics by connecting the geometric and algebraic definitions of the parabola.

**Unit 5 Circles With and Without Coordinates:** In this unit students prove basic theorems about circles, such as a tangent line is perpendicular to a radius, inscribed angle theorem, and theorems about chords, secants, and tangents dealing with segment lengths and angle measures. They study relationships among segments on chords, secants, and tangents as an application of similarity. In the Cartesian coordinate system, students use the distance formula to write the equation of a circle when given the radius and the coordinates of its center. Given an equation of a circle, they draw the graph in the coordinate plane, and apply techniques for solving quadratic equations, which relates back to work done in the first course, to determine intersections between lines and circles or parabolas and between two circles.

## **GENERAL NOTES**

### **English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access

an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

## COURSE STANDARDS

| Name                               | Description  |
|------------------------------------|--|
| <a href="#">MAFS.912.G-CO.1.1:</a> | Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.  |
| <a href="#">MAFS.912.G-CO.1.2:</a> | Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch). |
| <a href="#">MAFS.912.G-CO.1.3:</a> | Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.   |
| <a href="#">MAFS.912.G-CO.1.4:</a> | Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.   |
| <a href="#">MAFS.912.G-CO.1.5:</a> | Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.   |
| <a href="#">MAFS.912.G-CO.2.6:</a> | Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.   |
| <a href="#">MAFS.912.G-CO.2.7:</a> | Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.   |
| <a href="#">MAFS.912.G-CO.2.8:</a> | Explain how the criteria for triangle congruence (ASA, SAS, SSS, and Hypotenuse-Leg) follow from the definition of congruence in terms of rigid motions.   |
| <a href="#">MAFS.912.G-CO.3.9:</a> | Prove theorems about lines and angles; use theorems about lines and angles to solve problems. <i>Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line</i>          |

|  |   |
|--|---|
|  | <i>segment are exactly those equidistant from the segment's endpoints.</i>  |
| <a href="#"><u>MAFS.912.G-CO.3.10:</u></a> | Prove theorems about triangles; use theorems about triangles to solve problems. <i>Theorems include: measures of interior angles of a triangle sum to <math>180^\circ</math>; triangle inequality theorem; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.</i>   |
| <a href="#"><u>MAFS.912.G-CO.3.11:</u></a> | Prove theorems about parallelograms; use theorems about parallelograms to solve problems. <i>Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.</i>   |
| <a href="#"><u>MAFS.912.G-CO.4.12:</u></a> | <p>Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). <i>Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.</i></p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/> <b>Geometry - Fluency Recommendations</b></p> <p>Fluency with the use of construction tools, physical and computational, helps students draft a model of a geometric phenomenon and can lead to conjectures and proofs.</p> </div> |
| <a href="#"><u>MAFS.912.G-CO.4.13:</u></a> | Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.   |
| <a href="#"><u>MAFS.912.G-SRT.1.1:</u></a> | <p>Verify experimentally the properties of dilations given by a center and a scale factor:</p> <ol style="list-style-type: none"> <li>a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.</li> <li>b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.</li> </ol>  |
| <a href="#"><u>MAFS.912.G-SRT.1.2:</u></a> | Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.  |

|                                      |  |
|--------------------------------------|--|
| <a href="#">MAFS.912.G-SRT.1.3:</a>  | Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.  |
| <a href="#">MAFS.912.G-SRT.2.4:</a>  | Prove theorems about triangles. <i>Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.</i>   |
| <a href="#">MAFS.912.G-SRT.2.5:</a>  | Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.<br><br><b>Remarks/Examples:<br/>Geometry - Fluency Recommendations</b><br><br>Fluency with the triangle congruence and similarity criteria will help students throughout their investigations of triangles, quadrilaterals, circles, parallelism, and trigonometric ratios. These criteria are necessary tools in many geometric modeling tasks. |
| <a href="#">MAFS.912.G-SRT.3.6:</a>  | Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.   |
| <a href="#">MAFS.912.G-SRT.3.7:</a>  | Explain and use the relationship between the sine and cosine of complementary angles.  |
| <a href="#">MAFS.912.G-SRT.3.8:</a>  | Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. ★   |
| <a href="#">MAFS.912.G-SRT.4.10:</a> | Prove the Laws of Sines and Cosines and use them to solve problems.  |
| <a href="#">MAFS.912.G-SRT.4.11:</a> | Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).   |
| <a href="#">MAFS.912.G-C.1.1:</a>    | Prove that all circles are similar.  |
| <a href="#">MAFS.912.G-C.1.2:</a>    | Identify and describe relationships among inscribed angles, radii, and chords. <i>Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.</i>   |
| <a href="#">MAFS.912.G-C.1.3:</a>    | Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.   |
| <a href="#">MAFS.912.G-C.1.4:</a>    | Construct a tangent line from a point outside a given circle to the circle.  |
| <a href="#">MAFS.912.G-C.2.5:</a>    | Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define  |

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|                                     | the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.   |
| <a href="#">MAFS.912.G-GPE.1.1:</a> | Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.  |
| <a href="#">MAFS.912.G-GPE.1.2:</a> | Derive the equation of a parabola given a focus and directrix.   |
| <a href="#">MAFS.912.G-GPE.1.3:</a> | Derive the equations of ellipses and hyperbolas given the foci and directrices.  |
| <a href="#">MAFS.912.G-GPE.2.4:</a> | <p>Use coordinates to prove simple geometric theorems algebraically. <i>For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point <math>(1, \sqrt{3})</math> lies on the circle centered at the origin and containing the point <math>(0, 2)</math>.</i></p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/><b>Geometry - Fluency Recommendations</b></p> <p>Fluency with the use of coordinates to establish geometric results, calculate length and angle, and use geometric representations as a modeling tool are some of the most valuable tools in mathematics and related fields.</p> </div> |
| <a href="#">MAFS.912.G-GPE.2.5:</a> | <p>Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/><b>Geometry - Fluency Recommendations</b></p> <p>Fluency with the use of coordinates to establish geometric results, calculate length and angle, and use geometric representations as a modeling tool are some of the most valuable tools in mathematics and related fields.</p> </div>  |
| <a href="#">MAFS.912.G-GPE.2.6:</a> | Find the point on a directed line segment between two given points that partitions the segment in a given ratio.   |
| <a href="#">MAFS.912.G-GPE.2.7:</a> | Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula. ★   |
|                                     | <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/><b>Geometry - Fluency Recommendations</b></p> </div>  |

Fluency with the use of coordinates to establish geometric results, calculate length and angle, and use geometric representations as a modeling tool are some of the most valuable tools in mathematics and related fields.

[MAFS.912.G-GMD.1.1:](#)

Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. *Use dissection arguments, Cavalieri's principle, and informal limit arguments.*

[MAFS.912.G-GMD.1.2:](#)

Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.

[MAFS.912.G-GMD.1.3:](#)

Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. ★

[MAFS.912.G-GMD.2.4:](#)

Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.

[MAFS.912.G-MG.1.1:](#)

Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). ★

[MAFS.912.G-MG.1.2:](#)

Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). ★

[MAFS.912.G-MG.1.3:](#)

Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios). ★

[LAFS.910.SL.1.1:](#)

Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

- a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.
- b. Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed.
- c. Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and

conclusions.

- d. Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.

[LAFS.910.SL.1.2:](#)

Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.

[LAFS.910.SL.1.3:](#)

Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.

[LAFS.910.SL.2.4:](#)

Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

[LAFS.910.RST.1.3:](#)

Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

[LAFS.910.RST.2.4:](#)

Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.

[LAFS.910.RST.3.7:](#)

Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

[LAFS.910.WHST.1.1:](#)

Write arguments focused on *discipline-specific content*.

- a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.
- b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience's knowledge level and concerns.
- c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.
- d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

|                                    |  |
|------------------------------------|--|
|                                    | e. Provide a concluding statement or section that follows from or supports the argument presented.   |
| <a href="#">LAFS.910.WHST.2.4:</a> | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.   |
| <a href="#">LAFS.910.WHST.3.9:</a> | Draw evidence from informational texts to support analysis, reflection, and research.  |
| <a href="#">MAFS.K12.MP.1.1:</a>   | <p><b>Make sense of problems and persevere in solving them.</b></p> <p>Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need.</p> <p>Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.</p> |
| <a href="#">MAFS.K12.MP.2.1:</a>   | <p><b>Reason abstractly and quantitatively.</b></p> <p>Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand;</p>  |



considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

**Construct viable arguments and critique the reasoning of others.**

[MAFS.K12.MP.3.1:](#)

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

**Model with mathematics.**

[MAFS.K12.MP.4.1:](#)

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results

make sense, possibly improving the model if it has not served its purpose.

**Use appropriate tools strategically.**

[MAFS.K12.MP.5.1:](#)

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

**Attend to precision.**

[MAFS.K12.MP.6.1:](#)

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

**Look for and make use of structure.**

[MAFS.K12.MP.7.1:](#)

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals

the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

**Look for and express regularity in repeated reasoning.**

[MAFS.K12.MP.8.1:](#)

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.AC.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.

## Analytic Geometry Honors (#1206330)

**Version for Academic Year:** 2015 - 2016

**Course Number:** 1206330

**Abbreviated Title:** ANLY GEO HON

**Number of Credits:** Half credit (.5)

**Course Length:** Semester (S)

**Honors?** Yes

**Course Level:** 3

**Course Status:** Draft - Course Pending Approval

### GENERAL NOTES

#### English Language Development ELD Standards Special Notes Section:

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

### COURSE STANDARDS

| Name                               | Description   |
|------------------------------------|---|
| <a href="#">MAFS.912.N-RN.1.1:</a> | Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. <i>For example, we define <math>5^{1/3}</math> to be the cube root of 5 because we want <math>(5^{1/3})^3 = 5^{(1/3)3}</math> to hold, so <math>(5^{1/3})^3</math> must equal 5.</i> |
| <a href="#">MAFS.912.N-RN.1.2:</a> | Rewrite expressions involving radicals and rational exponents using the properties of exponents.  |

|                                     |   |
|-------------------------------------|---|
| <a href="#">MAFS.912.N-RN.2.3:</a>  | <p>Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.</p>  |
| <a href="#">MAFS.912.N-CN.1.1:</a>  | <p>Know there is a complex number <math>i</math> such that <math>i^2 = -1</math>, and every complex number has the form <math>a + bi</math> with <math>a</math> and <math>b</math> real.</p>  |
| <a href="#">MAFS.912.N-CN.1.2:</a>  | <p>Use the relation <math>i^2 = -1</math> and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.</p>   |
| <a href="#">MAFS.912.N-CN.1.3:</a>  | <p>Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.</p>  |
| <a href="#">MAFS.912.N-CN.3.7:</a>  | <p>Solve quadratic equations with real coefficients that have complex solutions.</p>  |
| <a href="#">MAFS.912.A-SSE.1.1:</a> | <p>Interpret expressions that represent a quantity in terms of its context. ★</p> <ol style="list-style-type: none"> <li>Interpret parts of an expression, such as terms, factors, and coefficients.</li> <li>Interpret complicated expressions by viewing one or more of their parts as a single entity. <i>For example, interpret <math>P(1+r)^n</math> as the product of <math>P</math> and a factor not depending on <math>P</math>.</i></li> </ol>   |
| <a href="#">MAFS.912.A-SSE.1.2:</a> | <p>Use the structure of an expression to identify ways to rewrite it. <i>For example, see <math>x^4 - y^4</math> as <math>(x^2)^2 - (y^2)^2</math>, thus recognizing it as a difference of squares that can be factored as <math>(x^2 - y^2)(x^2 + y^2)</math>.</i></p>   |
| <a href="#">MAFS.912.A-APR.1.1:</a> | <p>Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.</p> <div style="border: 1px solid black; padding: 10px; margin-top: 10px;"> <p><b>Remarks/Examples:</b><br/> <b>Algebra 1 - Fluency Recommendations</b></p> <p>Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in algebra, as well as in their symbolic work with functions. Manipulation can be more mindful when it is fluent.</p> </div> |
| <a href="#">MAFS.912.A-CED.1.1:</a> | <p>Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational, absolute, and</p>  |

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|                                     | exponential functions. ★   |
| <a href="#">MAFS.912.A-CED.1.2:</a> | Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. ★  |
| <a href="#">MAFS.912.A-CED.1.4:</a> | Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. <i>For example, rearrange Ohm's law <math>V = IR</math> to highlight resistance <math>R</math>.</i> ★  |
| <a href="#">MAFS.912.A-REI.2.4:</a> | Solve quadratic equations in one variable. <ul style="list-style-type: none"> <li>a. Use the method of completing the square to transform any quadratic equation in <math>x</math> into an equation of the form <math>(x - p)^2 = q</math> that has the same solutions. Derive the quadratic formula from this form.</li> <li>b. Solve quadratic equations by inspection (e.g., for <math>x^2 = 49</math>), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as <math>a \pm bi</math> for real numbers <math>a</math> and <math>b</math>.</li> </ul> |
| <a href="#">MAFS.912.A-REI.3.7:</a> | Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. <i>For example, find the points of intersection between the line <math>y = -3x</math> and the circle <math>x^2 + y^2 = 3</math>.</i>  |
| <a href="#">MAFS.912.F-IF.2.4:</a>  | For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. <i>Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</i> ★  |
| <a href="#">MAFS.912.F-IF.2.5:</a>  | Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. <i>For example, if the function <math>h(n)</math> gives the number of person-hours it takes to assemble engines in a factory, then the positive integers would be an appropriate domain for the function.</i> ★   |
| <a href="#">MAFS.912.F-IF.2.6:</a>  | Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. ★   |
| <a href="#">MAFS.912.F-IF.3.7:</a>  | Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★  |

- a. Graph linear and quadratic functions and show intercepts, maxima, and minima.
- b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
- c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.
- d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.
- e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.

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| <a href="#">MAFS.912.F-IF.3.9:</a>  | Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). <i>For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.</i>  |
| <a href="#">MAFS.912.F-BF.2.3:</a>  | Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$ , $k f(x)$ , $f(kx)$ , and $f(x + k)$ for specific values of $k$ (both positive and negative); find the value of $k$ given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. <i>Include recognizing even and odd functions from their graphs and algebraic expressions for them.</i> |
| <a href="#">MAFS.912.F-LE.1.3:</a>  | Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. ★  |
| <a href="#">MAFS.912.G-SRT.1.1:</a> | Verify experimentally the properties of dilations given by a center and a scale factor: <ol style="list-style-type: none"> <li>a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.</li> <li>b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.</li> </ol>             |
| <a href="#">LAFS.1112.RST.1.3:</a>  | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the   |

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|                                     | text.   |
| <a href="#">LAFS.1112.RST.2.4:</a>  | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.  |
| <a href="#">LAFS.1112.RST.3.7:</a>  | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.   |
| <a href="#">LAFS.1112.WHST.1.1:</a> | <p>Write arguments focused on <i>discipline-specific content</i>.</p> <ol style="list-style-type: none"> <li>Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.</li> <li>Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience’s knowledge level, concerns, values, and possible biases.</li> <li>Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.</li> <li>Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.</li> <li>Provide a concluding statement or section that follows from or supports the argument presented.</li> </ol> |
| <a href="#">LAFS.1112.WHST.2.4:</a> | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.  |
| <a href="#">LAFS.1112.WHST.3.9:</a> | Draw evidence from informational texts to support analysis, reflection, and research.   |
| <a href="#">MAFS.K12.MP.1.1:</a>    | <p><b>Make sense of problems and persevere in solving them.</b></p> <p>Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather</p>  |



than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

**Reason abstractly and quantitatively.**

[MAFS.K12.MP.2.1:](#)

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

[MAFS.K12.MP.3.1:](#)

**Construct viable arguments and critique the reasoning of others.**

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account

the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

**Model with mathematics.**

[MAFS.K12.MP.4.1:](#)

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

[MAFS.K12.MP.5.1:](#)

**Use appropriate tools strategically.**

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible

errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

**Attend to precision.**

[MAFS.K12.MP.6.1:](#)

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

**Look for and make use of structure.**

[MAFS.K12.MP.7.1:](#)

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

[MAFS.K12.MP.8.1:](#)

**Look for and express regularity in repeated reasoning.**

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.AC.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.

[MAFS.912.A-SSE.2.3a:](#)

a. Factor a quadratic expression to reveal the zeros of the function it defines.

[MAFS.912.A-SSE.2.3b:](#)

b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.

[MAFS.912.F-IF.3.8a:](#)

a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.

[MAFS.912.F-BF.1.1a:](#)

a. Determine an explicit expression, a recursive process, or steps for calculation from a context.

[MAFS.912.F-BF.1.1b:](#)

b. Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.

[MAFS.912.S-ID.2.6a:](#)

a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, and exponential models.

## **Mathematics - Grade Kindergarten (#5012020)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 5012020

**Abbreviated Title:** MATH GRADE K

**Course Length:** Year (Y)

**Course Type:** Core

**Course Status:** Draft - Course Pending Approval

### **GENERAL NOTES**

#### **English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

### **COURSE STANDARDS**

#### **MAFS.K**

In Kindergarten, instructional time should focus on two critical areas: (1) representing, relating, and operating on whole numbers, initially with sets of objects; (2) describing shapes and space. More learning time in Kindergarten should be devoted to number than to other topics.

(1) Students use numbers, including written numerals, to represent quantities and to solve quantitative problems, such as counting objects in a set; counting out a given number of objects; comparing sets or numerals; and modeling simple joining and separating situations with sets of objects, or eventually with equations such as  $5 + 2 = 7$  and  $7 - 2 = 5$ . (Kindergarten students should see addition and subtraction equations, and student writing of equations in kindergarten is encouraged, but it is not required.) Students choose, combine, and apply effective strategies for answering quantitative questions,

including quickly recognizing the cardinals of small sets of objects, counting and producing sets of given sizes, counting the number of objects in combined sets, or counting the number of objects that remain in a set after some are taken away.

(2) Students describe their physical world using geometric ideas (e.g., shape, orientation, spatial relations) and vocabulary. They identify, name, and describe basic two-dimensional shapes, such as squares, triangles, circles, rectangles, and hexagons, presented in a variety of ways (e.g., with different sizes and orientations), as well as three-dimensional shapes such as cubes, cones, cylinders, and spheres. They use basic shapes and spatial reasoning to model objects in their environment and to construct more complex shapes.

| Name                           | Description   |
|--------------------------------|---|
| <a href="#">MAFS.K.CC.1.1:</a> | Count to 100 by ones and by tens.   |
| <a href="#">MAFS.K.CC.1.2:</a> | Count forward beginning from a given number within the known sequence (instead of having to begin at 1).  |
| <a href="#">MAFS.K.CC.1.3:</a> | Read and write numerals from 0 to 20. Represent a number of objects with a written numeral 0–20 (with 0 representing a count of no objects).  |
| <a href="#">MAFS.K.CC.2.4:</a> | <p>Understand the relationship between numbers and quantities; connect counting to cardinality.</p> <ul style="list-style-type: none"> <li>a. When counting objects, say the number names in the standard order, pairing each object with one and only one number name and each number name with one and only one object.</li> <li>b. Understand that the last number name said tells the number of objects counted. The number of objects is the same regardless of their arrangement or the order in which they were counted.</li> <li>c. Understand that each successive number name refers to a quantity that is one larger.</li> </ul> |
| <a href="#">MAFS.K.CC.2.5:</a> | Count to answer “how many?” questions about as many as 20 things arranged in a line, a rectangular array, or a circle, or as many as 10 things in a scattered configuration; given a number from 1–20, count out that many objects.   |
| <a href="#">MAFS.K.CC.3.6:</a> | Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group, e.g., by using matching and counting strategies.  |
| <a href="#">MAFS.K.CC.3.7:</a> | Compare two numbers between 1 and 10 presented as written numerals.   |
| <a href="#">MAFS.K.OA.1.1:</a> | Represent addition and subtraction with objects, fingers, mental images, drawings, sounds (e.g., claps), acting out situations, verbal explanations, expressions, or equations.   |

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| <a href="#">MAFS.K.OA.1.2:</a>  | Solve addition and subtraction word problems <sup>1</sup> , and add and subtract within 10, e.g., by using objects or drawings to represent the problem ( <sup>1</sup> Students are not required to independently read the word problems.)  |
| <a href="#">MAFS.K.OA.1.4:</a>  | For any number from 1 to 9, find the number that makes 10 when added to the given number, e.g., by using objects or drawings, and record the answer with a drawing or equation.   |
| <a href="#">MAFS.K.OA.1.5:</a>  | Fluently add and subtract within 5.   |
| <a href="#">MAFS.K.OA.1.a:</a>  | Use addition and subtraction within 10 to solve word problems involving both addends unknown, e.g., by using objects, drawings, and equations with symbols for the unknown numbers to represent the problem. (Students are not required to independently read the word problems.)   |
| <a href="#">MAFS.K.NBT.1.1:</a> | Compose and decompose numbers from 11 to 19 into ten ones and some further ones, e.g., by using objects or drawings, and record each composition or decomposition by a drawing or equation (e.g., $18 = 10 + 8$ ); understand that these numbers are composed of ten ones and one, two, three, four, five, six, seven, eight, or nine ones.   |
| <a href="#">MAFS.K.MD.1.1:</a>  | Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object.   |
| <a href="#">MAFS.K.MD.1.2:</a>  | Directly compare two objects with a measurable attribute in common, to see which object has “more of”/“less of” the attribute, and describe the difference. <i>For example, directly compare the heights of two children and describe one child as taller/shorter.</i>  |
| <a href="#">MAFS.K.MD.1.a:</a>  | Express the length of an object as a whole number of length units, by laying multiple copies of a shorter object (the length unit) end to end; understand that the length measurement of an object is the number of same-size length units that span it with no gaps or overlaps. <i>Limit to contexts where the object being measured is spanned by a whole number of length units with no gaps or overlaps.</i> |
| <a href="#">MAFS.K.MD.2.3:</a>  | Classify objects into given categories; count the numbers of objects in each category and sort the categories by count.   |
| <a href="#">MAFS.K.G.1.1:</a>   | Describe objects in the environment using names of shapes, and describe the relative positions of these objects using terms such as <i>above, below, beside, in front of, behind, and next to.</i>  |
| <a href="#">MAFS.K.G.1.2:</a>   | Correctly name shapes regardless of their orientations or overall size.   |
| <a href="#">MAFS.K.G.1.3:</a>   | Identify shapes as two-dimensional (lying in a plane, “flat”) or three-dimensional (“solid”).   |
| <a href="#">MAFS.K.G.2.4:</a>   | Analyze and compare two- and three-dimensional shapes, in different sizes and orientations, using informal language to describe their similarities, differences, parts (e.g., number of sides and vertices/“corners”) and other attributes (e.g., having sides of   |

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|                                  | equal length).  |
| <a href="#">MAFS.K.G.2.5:</a>    | Model shapes in the world by building shapes from components (e.g., sticks and clay balls) and drawing shapes.  |
| <a href="#">MAFS.K.G.2.6:</a>    | Compose simple shapes to form larger shapes. <i>For example, “Can you join these two triangles with full sides touching to make a rectangle?”</i>   |
| <a href="#">LAFS.K.W.1.2:</a>    | Use a combination of drawing, dictating, and writing to compose informative/explanatory texts in which they name what they are writing about and supply some information about the topic.   |
| <a href="#">LAFS.K.SL.1.1:</a>   | Participate in collaborative conversations with diverse partners about <i>kindergarten topics</i> and texts with peers and adults in small and larger groups. <ul style="list-style-type: none"> <li>a. Follow agreed-upon rules for discussions (e.g., listening to others and taking turns speaking about the topics and texts under discussion).</li> <li>b. Continue a conversation through multiple exchanges.</li> </ul>  |
| <a href="#">LAFS.K.SL.1.2:</a>   | Confirm understanding of a text read aloud or information presented orally or through other media by asking and answering questions about key details and requesting clarification if something is not understood.  |
| <a href="#">LAFS.K.SL.1.3:</a>   | Ask and answer questions in order to seek help, get information, or clarify something that is not understood.   |
| <a href="#">MAFS.K12.MP.1.1:</a> | <p><b>Make sense of problems and persevere in solving them.</b></p> <p>Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves,</p> |



“Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

**Reason abstractly and quantitatively.**

[MAFS.K12.MP.2.1:](#)

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

**Construct viable arguments and critique the reasoning of others.**

[MAFS.K12.MP.3.1:](#)

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

[MAFS.K12.MP.4.1:](#)

**Model with mathematics.**

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

**Use appropriate tools strategically.**

[MAFS.K12.MP.5.1:](#)

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

**Attend to precision.**

[MAFS.K12.MP.6.1:](#)

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols

they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

**Look for and make use of structure.**

[MAFS.K12.MP.7.1:](#)

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

**Look for and express regularity in repeated reasoning.**

[MAFS.K12.MP.8.1:](#)

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional

purposes within the school setting.

[ELD.K12.ELL.AC.1](#): English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.

## **Mathematics - Grade One (#5012030)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 5012030

**Abbreviated Title:** MATH GRADE ONE

**Course Length:** Year (Y)

**Course Type:** Core

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 1

### **GENERAL NOTES**

#### **English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

### **COURSE STANDARDS**

#### **MAFS.1**

In Grade 1, instructional time should focus on four critical areas: (1) developing understanding of addition, subtraction, and strategies for addition and subtraction within 20; (2) developing understanding of whole number relationships and place value, including grouping in tens and ones; (3) developing understanding of linear measurement and measuring lengths as iterating length units; and (4) reasoning about attributes of, and composing and decomposing geometric shapes.

1. Students develop strategies for adding and subtracting whole numbers based on their prior work with small numbers. They use a variety of models, including discrete objects and length-based models (e.g., cubes connected to form lengths), to model add-to, take-from, put-together, take-apart, and compare situations to

- develop meaning for the operations of addition and subtraction, and to develop strategies to solve arithmetic problems with these operations. Students understand connections between counting and addition and subtraction (e.g., adding two is the same as counting on two). They use properties of addition to add whole numbers and to create and use increasingly sophisticated strategies based on these properties (e.g., “making tens”) to solve addition and subtraction problems within 20. By comparing a variety of solution strategies, children build their understanding of the relationship between addition and subtraction.
2. Students develop, discuss, and use efficient, accurate, and generalizable methods to add within 100 and subtract multiples of 10. They compare whole numbers (at least to 100) to develop understanding of and solve problems involving their relative sizes. They think of whole numbers between 10 and 100 in terms of tens and ones (especially recognizing the numbers 11 to 19 as composed of a ten and some ones). Through activities that build number sense, they understand the order of the counting numbers and their relative magnitudes.
  3. Students develop an understanding of the meaning and processes of measurement, including underlying concepts such as iterating (the mental activity of building up the length of an object with equal-sized units) and the transitivity principle for indirect measurement. Note: Students should apply the principle of transitivity of measurement to make indirect comparisons, but they need not use this technical term.
  4. Students compose and decompose plane or solid figures (e.g., put two triangles together to make a quadrilateral) and build understanding of part-whole relationships as well as the properties of the original and composite shapes. As they combine shapes, they recognize them from different perspectives and orientations, describe their geometric attributes, and determine how they are alike and different, to develop the background for measurement and for initial understandings of properties such as congruence and symmetry.

| Name                           | Description  |
|--------------------------------|--|
| <a href="#">MAFS.1.OA.1.1:</a> | Use addition and subtraction within 20 to solve word problems <sup>1</sup> involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem ( <sup>1</sup> Students are not required to independently read the word problems.) |
| <a href="#">MAFS.1.OA.1.2:</a> | Solve word problems that call for addition of three whole numbers whose sum is less than or equal to 20, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem.  |
| <a href="#">MAFS.1.OA.2.3:</a> | Apply properties of operations as strategies to add and subtract.<br><i>Examples: If <math>8 + 3 = 11</math> is known, then <math>3 + 8 = 11</math> is also known. (Commutative property of addition.) To add <math>2 + 6 + 4</math>, the second two numbers can be added to make a ten, so <math>2 + 6 + 4 = 2 + 10 =</math></i>  |

|                                 |  |
|---------------------------------|--|
|                                 | <i>12. (Associative property of addition.)</i>   |
| <a href="#">MAFS.1.OA.2.4:</a>  | Understand subtraction as an unknown-addend problem. <i>For example, subtract <math>10 - 8</math> by finding the number that makes 10 when added to 8.</i>   |
| <a href="#">MAFS.1.OA.3.5:</a>  | Relate counting to addition and subtraction (e.g., by counting on 2 to add 2).   |
| <a href="#">MAFS.1.OA.3.6:</a>  | Add and subtract within 20, demonstrating fluency for addition and subtraction within 10. Use strategies such as counting on; making ten (e.g., $8 + 6 = 8 + 2 + 4 = 10 + 4 = 14$ ); decomposing a number leading to a ten (e.g., $13 - 4 = 13 - 3 - 1 = 10 - 1 = 9$ ); using the relationship between addition and subtraction (e.g., knowing that $8 + 4 = 12$ , one knows $12 - 8 = 4$ ); and creating equivalent but easier or known sums (e.g., adding $6 + 7$ by creating the known equivalent $6 + 6 + 1 = 12 + 1 = 13$ ).  |
| <a href="#">MAFS.1.OA.4.7:</a>  | Understand the meaning of the equal sign, and determine if equations involving addition and subtraction are true or false. <i>For example, which of the following equations are true and which are false? <math>6 = 6</math>, <math>7 = 8 - 1</math>, <math>5 + 2 = 2 + 5</math>, <math>4 + 1 = 5 + 2</math>.</i>  |
| <a href="#">MAFS.1.OA.4.8:</a>  | Determine the unknown whole number in an addition or subtraction equation relating to three whole numbers. <i>For example, determine the unknown number that makes the equation true in each of the equations <math>8 + ? = 11</math>, <math>5 = [] - 3</math>, <math>6 + 6 = []</math>.</i>   |
| <a href="#">MAFS.1.NBT.1.1:</a> | Count to 120, starting at any number less than 120. In this range, read and write numerals and represent a number of objects with a written numeral.   |
| <a href="#">MAFS.1.NBT.2.2:</a> | Understand that the two digits of a two-digit number represent amounts of tens and ones. <ul style="list-style-type: none"> <li>a. 10 can be thought of as a bundle of ten ones — called a “ten.”</li> <li>b. The numbers from 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones.</li> <li>c. The numbers 10, 20, 30, 40, 50, 60, 70, 80, 90 refer to one, two, three, four, five, six, seven, eight, or nine tens (and 0 ones).</li> <li>d. Decompose two-digit numbers in multiple ways (e.g., 64 can be decomposed into 6 tens and 4 ones or into 5 tens and 14 ones).</li> </ul> |
| <a href="#">MAFS.1.NBT.2.3:</a> | Compare two two-digit numbers based on meanings of the tens and ones digits, recording the results of comparisons with the symbols $>$ , $=$ , and $<$ .   |
| <a href="#">MAFS.1.NBT.3.4:</a> | Add within 100, including adding a two-digit number and a one-digit number, and adding a two-digit number and a multiple of 10,  |

|                                 |   |
|---------------------------------|---|
|                                 | using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used. Understand that in adding two-digit numbers, one adds tens and tens, ones and ones; and sometimes it is necessary to compose a ten.  |
| <a href="#">MAFS.1.NBT.3.5:</a> | Given a two-digit number, mentally find 10 more or 10 less than the number, without having to count; explain the reasoning used.  |
| <a href="#">MAFS.1.NBT.3.6:</a> | Subtract multiples of 10 in the range 10-90 from multiples of 10 in the range 10-90 (positive or zero differences), using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.  |
| <a href="#">MAFS.1.MD.1.1:</a>  | Order three objects by length; compare the lengths of two objects indirectly by using a third object.   |
| <a href="#">MAFS.1.MD.1.a:</a>  | Understand how to use a ruler to measure length to the nearest inch. <ul style="list-style-type: none"> <li>a. Recognize that the ruler is a tool that can be used to measure the attribute of length.</li> <li>b. Understand the importance of the zero point and end point and that the length measure is the span between two points.</li> <li>c. Recognize that the units marked on a ruler have equal length intervals and fit together with no gaps or overlaps. These equal interval distances can be counted to determine the overall length of an object.</li> </ul>                                   |
| <a href="#">MAFS.1.MD.2.3:</a>  | Tell and write time in hours and half-hours using analog and digital clocks.  |
| <a href="#">MAFS.1.MD.2.a:</a>  | Identify and combine values of money in cents up to one dollar working with a single unit of currency <sup>1</sup> . <ul style="list-style-type: none"> <li>a. Identify the value of coins (pennies, nickels, dimes, quarters).</li> <li>b. Compute the value of combinations of coins (pennies and/or dimes).</li> <li>c. Relate the value of pennies, dimes, and quarters to the dollar (e.g., There are 100 pennies <i>or</i> ten dimes <i>or</i> four quarters in one dollar.) (<sup>1</sup>Students are not expected to understand the decimal notation for combinations of dollars and cents.)</li> </ul> |
| <a href="#">MAFS.1.MD.3.4:</a>  | Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points,  |



|                                  |  |
|----------------------------------|--|
|                                  | how many in each category, and how many more or less are in one category than in another.  |
| <a href="#">MAFS.1.G.1.1:</a>    | Distinguish between defining attributes (e.g., triangles are closed and three-sided) versus non-defining attributes (e.g., color, orientation, overall size); build and draw shapes to possess defining attributes.  |
| <a href="#">MAFS.1.G.1.2:</a>    | Compose two-dimensional shapes (rectangles, squares, trapezoids, triangles, half-circles, and quarter-circles) or three-dimensional shapes (cubes, right rectangular prisms, right circular cones, and right circular cylinders) to create a composite shape, and compose new shapes from the composite shape.   |
| <a href="#">MAFS.1.G.1.3:</a>    | Partition circles and rectangles into two and four equal shares, describe the shares using the words <i>halves</i> , <i>fourths</i> , and <i>quarters</i> , and use the phrases <i>half of</i> , <i>fourth of</i> , and <i>quarter of</i> . Describe the whole as two of, or four of the shares. Understand for these examples that decomposing into more equal shares creates smaller shares.   |
| <a href="#">LAFS.1.SL.1.1:</a>   | <p>Participate in collaborative conversations with diverse partners about grade 1 topics and texts with peers and adults in small and larger groups.</p> <ol style="list-style-type: none"> <li>Follow agreed-upon rules for discussions (e.g., listening to others with care, speaking one at a time about the topics and texts under discussion).</li> <li>Build on others' talk in conversations by responding to the comments of others through multiple exchanges.</li> <li>Ask questions to clear up any confusion about the topics and texts under discussion.</li> </ol> |
| <a href="#">LAFS.1.SL.1.2:</a>   | Ask and answer questions about key details in a text read aloud or information presented orally or through other media.  |
| <a href="#">LAFS.1.SL.1.3:</a>   | Ask and answer questions about what a speaker says in order to gather additional information or clarify something that is not understood.  |
| <a href="#">LAFS.K12.W.1.2:</a>  | Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.   |
| <a href="#">MAFS.K12.MP.1.1:</a> | <p><b>Make sense of problems and persevere in solving them.</b></p> <p>Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping</p>   |

into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

**Reason abstractly and quantitatively.**

[MAFS.K12.MP.2.1:](#)

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

**Construct viable arguments and critique the reasoning of others.**

[MAFS.K12.MP.3.1:](#)

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to

compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

**Model with mathematics.**

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another.

[MAFS.K12.MP.4.1:](#)

Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

**Use appropriate tools strategically.**

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making

[MAFS.K12.MP.5.1:](#)

mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

**Attend to precision.**

[MAFS.K12.MP.6.1:](#)

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

**Look for and make use of structure.**

[MAFS.K12.MP.7.1:](#)

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

**Look for and express regularity in repeated reasoning.**

[MAFS.K12.MP.8.1:](#)

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11

that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.AC.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.

## **Mathematics - Grade Two (#5012040)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 5012040

**Abbreviated Title:** MATH GRADE TWO

**Course Length:** Year (Y)

**Course Type:** Core

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 2

### **GENERAL NOTES**

#### **English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

### **COURSE STANDARDS**

#### **MAFS.2**

In Grade 2, instructional time should focus on four critical areas: (1) extending understanding of base-ten notation; (2) building fluency with addition and subtraction; (3) using standard units of measure; and (4) describing and analyzing shapes.

1. Students extend their understanding of the base-ten system. This includes ideas of counting in fives, tens, and multiples of hundreds, tens, and ones, as well as number relationships involving these units, including comparing. Students understand multi-digit numbers (up to 1000) written in base-ten notation, recognizing that the digits in each place represent amounts of thousands, hundreds, tens, or ones (e.g., 853 is 8 hundreds + 5 tens + 3 ones).

2. Students use their understanding of addition to develop fluency with addition and subtraction within 100. They solve problems within 1000 by applying their understanding

of models for addition and subtraction, and they develop, discuss, and use efficient, accurate, and generalization methods to compute sums and differences of whole numbers in base-ten notation, using their understanding of place value and the properties of operations. They select and accurately apply methods that are appropriate for the context and the numbers involved to mentally calculate sums and differences for numbers with only tens or only hundreds.

3. Students recognize the need for standard units of measure (centimeter and inch) and they use rulers and other measurement tools with the understanding that linear measure involves an iteration of units. They recognize that the smaller the unit, the more iterations they need to cover a given length.

4. Students describe and analyze shapes by examining their sides and angles. Students investigate, describe, and reason about decomposing and combining shapes to make other shapes. Through building, drawing, and analyzing two- and three-dimensional shapes, students develop a foundation for understanding area, volume, congruence, similarity, and symmetry in later grades.

| Name                            | Description  |
|---------------------------------|--|
| <a href="#">MAFS.2.OA.1.1:</a>  | Use addition and subtraction within 100 to solve one- and two-step word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem. |
| <a href="#">MAFS.2.OA.1.a:</a>  | Determine the unknown whole number in an equation relating four or more whole numbers. For example, determine the unknown number that makes the equation true in the equations $37 + 10 + 10 = \underline{\hspace{1cm}} + 18$ , $? - 6 = 13 - 4$ , and $15 - 9 = 6 + \square$ .                                      |
| <a href="#">MAFS.2.OA.2.2:</a>  | Fluently add and subtract within 20 using mental strategies. By end of Grade 2, know from memory all sums of two one-digit numbers.  |
| <a href="#">MAFS.2.OA.3.3:</a>  | Determine whether a group of objects (up to 20) has an odd or even number of members, e.g., by pairing objects or counting them by 2s; write an equation to express an even number as a sum of two equal addends.  |
| <a href="#">MAFS.2.OA.3.4:</a>  | Use addition to find the total number of objects arranged in rectangular arrays with up to 5 rows and up to 5 columns; write an equation to express the total as a sum of equal addends.   |
| <a href="#">MAFS.2.NBT.1.1:</a> | Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones; e.g., 706 equals 7 hundreds, 0 tens, and 6 ones. Understand the following as special cases:<br><br>a. 100 can be thought of as a bundle of ten tens — called a “hundred.”                                    |

|                                 |  |
|---------------------------------|--|
|                                 | b. The numbers 100, 200, 300, 400, 500, 600, 700, 800, 900 refer to one, two, three, four, five, six, seven, eight, or nine hundreds (and 0 tens and 0 ones).  |
| <a href="#">MAFS.2.NBT.1.2:</a> | Count within 1000; skip-count by 5s, 10s, and 100s.  |
| <a href="#">MAFS.2.NBT.1.3:</a> | Read and write numbers to 1000 using base-ten numerals, number names, and expanded form.   |
| <a href="#">MAFS.2.NBT.1.4:</a> | Compare two three-digit numbers based on meanings of the hundreds, tens, and ones digits, using $>$ , $=$ , and $<$ symbols to record the results of comparisons.  |
| <a href="#">MAFS.2.NBT.2.5:</a> | Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.  |
| <a href="#">MAFS.2.NBT.2.6:</a> | Add up to four two-digit numbers using strategies based on place value and properties of operations.   |
| <a href="#">MAFS.2.NBT.2.7:</a> | Add and subtract within 1000, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method. Understand that in adding or subtracting three digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds. |
| <a href="#">MAFS.2.NBT.2.8:</a> | Mentally add 10 or 100 to a given number 100–900, and mentally subtract 10 or 100 from a given number 100–900.   |
| <a href="#">MAFS.2.NBT.2.9:</a> | Explain why addition and subtraction strategies work, using place value and the properties of operations.  |
| <a href="#">MAFS.2.MD.1.1:</a>  | Measure the length of an object to the nearest inch, foot, centimeter, or meter by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.  |
| <a href="#">MAFS.2.MD.1.2:</a>  | Describe the inverse relationship between the size of a unit and number of units needed to measure a given object. <i>Example: Suppose the perimeter of a room is lined with one-foot rulers. Now, suppose we want to line it with yardsticks instead of rulers. Will we need more or fewer yardsticks than rulers to do the job? Explain your answer.</i>   |
| <a href="#">MAFS.2.MD.1.3:</a>  | Estimate lengths using units of inches, feet, yards, centimeters, and meters.  |
| <a href="#">MAFS.2.MD.1.4:</a>  | Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit.  |
| <a href="#">MAFS.2.MD.2.5:</a>  | Use addition and subtraction within 100 to solve word problems involving lengths that are given in the same units, e.g., by using drawings (such as drawings of rulers) and equations with a symbol for the unknown number to represent the problem.   |



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| <a href="#">MAFS.2.MD.2.6:</a>  | Represent whole numbers as lengths from 0 on a number line diagram with equally spaced points corresponding to the numbers 0, 1, 2, ..., and represent whole-number sums and differences within 100 on a number line diagram.  |
| <a href="#">MAFS.2.MD.3.7:</a>  | Tell and write time from analog and digital clocks to the nearest five minutes.  |
| <a href="#">MAFS.2.MD.3.8:</a>  | <p>Solve one- and two-step word problems involving dollar bills (singles, fives, tens, twenties, and hundreds) or coins (quarters, dimes, nickels, and pennies) using \$ and ¢ symbols appropriately. Word problems may involve addition, subtraction, and equal groups situations<sup>1</sup>. <i>Example: The cash register shows that the total for your purchase is 59¢. You gave the cashier three quarters. How much change should you receive from the cashier?</i></p> <ol style="list-style-type: none"> <li>Identify the value of coins and paper currency.</li> <li>Compute the value of any combination of coins within one dollar.</li> <li>Compute the value of any combinations of dollars (e.g., If you have three ten-dollar bills, one five-dollar bill, and two one-dollar bills, how much money do you have?).</li> <li>Relate the value of pennies, nickels, dimes, and quarters to other coins and to the dollar (e.g., There are five nickels in one quarter. There are two nickels in one dime. There are two and a half dimes in one quarter. There are twenty nickels in one dollar).</li> </ol> <p>(<sup>1</sup>See glossary <a href="#">Table 1</a>)</p> |
| <a href="#">MAFS.2.MD.4.9:</a>  | Generate measurement data by measuring lengths of several objects to the nearest whole unit, or by making repeated measurements of the same object. Show the measurements by making a line plot, where the horizontal scale is marked off in whole-number units.   |
| <a href="#">MAFS.2.MD.4.10:</a> | Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph.  |
| <a href="#">MAFS.2.G.1.1:</a>   | Recognize and draw shapes having specified attributes, such as a given number of angles or a given number of equal faces. Identify triangles, quadrilaterals, pentagons, hexagons, and cubes.  |
| <a href="#">MAFS.2.G.1.2:</a>   | Partition a rectangle into rows and columns of same-size squares and count to find the total number of them.   |
| <a href="#">MAFS.2.G.1.3:</a>   | Partition circles and rectangles into two, three, or four equal shares, describe the shares using the words <i>halves</i> , <i>thirds</i> , <i>half of</i> , <i>a third of</i> , etc., and describe the whole as two halves, three thirds, four fourths. Recognize that equal shares of identical wholes need not  |

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|                                  | have the same shape.  |
| <a href="#">LAFS.2.W.1.2:</a>    | Write informative/explanatory texts in which they introduce a topic, use facts and definitions to develop points, and provide a concluding statement or section.  |
| <a href="#">LAFS.2.SL.1.1:</a>   | <p>Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups.</p> <ol style="list-style-type: none"> <li>Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion).</li> <li>Build on others' talk in conversations by linking their comments to the remarks of others.</li> <li>Ask for clarification and further explanation as needed about the topics and texts under discussion.</li> </ol>  |
| <a href="#">LAFS.2.SL.1.2:</a>   | Recount or describe key ideas or details from a text read aloud or information presented orally or through other media.   |
| <a href="#">LAFS.2.SL.1.3:</a>   | Ask and answer questions about what a speaker says in order to clarify comprehension, gather additional information, or deepen understanding of a topic or issue.   |
| <a href="#">MAFS.K12.MP.1.1:</a> | <p><b>Make sense of problems and persevere in solving them.</b></p> <p>Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" They can understand the approaches of others to solving complex problems and identify correspondences</p> |

between different approaches.

**Reason abstractly and quantitatively.**

[MAFS.K12.MP.2.1:](#)

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

**Construct viable arguments and critique the reasoning of others.**

[MAFS.K12.MP.3.1:](#)

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

**Model with mathematics.**

[MAFS.K12.MP.4.1:](#)

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the

workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

**Use appropriate tools strategically.**

[MAFS.K12.MP.5.1:](#)

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

**Attend to precision.**

[MAFS.K12.MP.6.1:](#)

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure,

and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

**Look for and make use of structure.**

[MAFS.K12.MP.7.1:](#)

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

**Look for and express regularity in repeated reasoning.**

[MAFS.K12.MP.8.1:](#)

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through  $(1, 2)$  with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.AC.1:](#)

English language learners communicate information, ideas and

concepts necessary for academic success in the content area of  
Mathematics.

## **Mathematics - Grade Three (#5012050)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 5012050

**Abbreviated Title:** MATH GRADE THREE

**Course Length:** Year (Y)

**Course Type:** Core

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 3

### **GENERAL NOTES**

MAFS.3

In Grade 3, instructional time should focus on four critical areas: (1) developing understanding of multiplication and division and strategies for multiplication and division within 100; (2) developing understanding of fractions, especially unit fractions (fractions with numerator 1); (3) developing understanding of the structure of rectangular arrays and of area; and (4) describing and analyzing two-dimensional shapes.

(1) Students develop an understanding of the meanings of multiplication and division of whole numbers through activities and problems involving equal-sized groups, arrays, and area models; multiplication is finding an unknown product, and division is finding an unknown factor in these situations. For equal-sized group situations, division can require finding the unknown number of groups or the unknown group size. Students use properties of operations to calculate products of whole numbers, using increasingly sophisticated strategies based on these properties to solve multiplication and division problems involving single-digit factors. By comparing a variety of solution strategies, students learn the relationship between multiplication and division.

(2) Students develop an understanding of fractions, beginning with unit fractions. Students view fractions in general as being built out of unit fractions, and they use fractions along with visual fraction models to represent parts of a whole. Students understand that the size of a fractional part is relative to the size of the whole. For example,  $\frac{1}{2}$  of the paint in a small bucket could be less paint than  $\frac{1}{3}$  of the paint in a larger bucket, but  $\frac{1}{3}$  of a ribbon is longer than  $\frac{1}{5}$  of the same ribbon because when the ribbon is divided into 3 equal parts, the parts are longer than when the ribbon is divided into 5 equal parts. Students are able to use fractions to represent numbers equal to, less than, and greater than one. They solve problems that involve comparing fractions by using visual fraction models and strategies based on noticing equal numerators or denominators.

(3) Students recognize area as an attribute of two-dimensional regions. They measure the area of a shape by finding the total number of same-size units of area required to cover the shape without gaps or overlaps, a square with sides of unit length being the standard unit for measuring area. Students understand that rectangular arrays can be decomposed into identical rows or into identical columns. By decomposing rectangles into rectangular arrays of squares, students connect area to multiplication, and justify using multiplication to determine the area of a rectangle.

(4) Students describe, analyze, and compare properties of two-dimensional shapes. They compare and classify shapes by their sides and angles, and connect these with definitions of shapes. Students also relate their fraction work to geometry by expressing the area of part of a shape as a unit fraction of the whole.

**English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL’s need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

**COURSE STANDARDS**

| Name                           | Description  |
|--------------------------------|--|
| <a href="#">MAFS.3.OA.1.1:</a> | <p>Interpret products of whole numbers, e.g., interpret <math>5 \times 7</math> as the total number of objects in 5 groups of 7 objects each. <i>For example, describe a context in which a total number of objects can be expressed as <math>5 \times 7</math>.</i></p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/> <b>Examples of Opportunities for In-Depth Focus</b></p> <p>Word problems involving equal groups, arrays, and</p> </div> |



measurement quantities can be used to build students' understanding of and skill with multiplication and division, as well as to allow students to demonstrate their understanding of and skill with these operations.

[MAFS.3.OA.1.2:](#)

Interpret whole-number quotients of whole numbers, e.g., interpret  $56 \div 8$  as the number of objects in each share when 56 objects are partitioned equally into 8 shares, or as a number of shares when 56 objects are partitioned into equal shares of 8 objects each. *For example, describe a context in which a number of shares or a number of groups can be expressed as  $56 \div 8$ .*

**Remarks/Examples:**

**Examples of Opportunities for In-Depth Focus**

Word problems involving equal groups, arrays, and measurement quantities can be used to build students' understanding of and skill with multiplication and division, as well as to allow students to demonstrate their understanding of and skill with these operations.

[MAFS.3.OA.1.3:](#)

Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.

**Remarks/Examples:**

**Examples of Opportunities for In-Depth Focus**

Word problems involving equal groups, arrays, and measurement quantities can be used to build students' understanding of and skill with multiplication and division, as well as to allow students to demonstrate their understanding of and skill with these operations.

[MAFS.3.OA.1.4:](#)

Determine the unknown whole number in a multiplication or division equation relating three whole numbers. *For example, determine the unknown number that makes the equation true in each of the equations  $8 \times ? = 48$ ,  $5 = [] \div 3$ ,  $6 \times 6 = ?$ .*

**Remarks/Examples:**

**Examples of Opportunities for In-Depth Focus**

Word problems involving equal groups, arrays, and

measurement quantities can be used to build students' understanding of and skill with multiplication and division, as well as to allow students to demonstrate their understanding of and skill with these operations.

[MAFS.3.OA.2.5:](#)

Apply properties of operations as strategies to multiply and divide. *Examples: If  $6 \times 4 = 24$  is known, then  $4 \times 6 = 24$  is also known. (Commutative property of multiplication.)  $3 \times 5 \times 2$  can be found by  $3 \times 5 = 15$ , then  $15 \times 2 = 30$ , or by  $5 \times 2 = 10$ , then  $3 \times 10 = 30$ . (Associative property of multiplication.) Knowing that  $8 \times 5 = 40$  and  $8 \times 2 = 16$ , one can find  $8 \times 7$  as  $8 \times (5 + 2) = (8 \times 5) + (8 \times 2) = 40 + 16 = 56$ . (Distributive property.)*

[MAFS.3.OA.2.6:](#)

Understand division as an unknown-factor problem. *For example, find  $32 \div 8$  by finding the number that makes 32 when multiplied by 8.*

Fluently multiply and divide within 100, using strategies such as the relationship between multiplication and division (e.g., knowing that  $8 \times 5 = 40$ , one knows  $40 \div 5 = 8$ ) or properties of operations. By the end of Grade 3, know from memory all products of two one-digit numbers.

[MAFS.3.OA.3.7:](#)

**Remarks/Examples:**

**Fluency Expectations or Examples of Culminating Standards**

Students fluently multiply and divide within 100. By the end of grade 3, they know all products of two one-digit numbers from memory. Multiplication and division are new in grade 3, and meeting the multiplication and division fluency standard 3.OA.3.7 with understanding is a major portion of students' work in grade 3.

**Examples of Opportunities for In-Depth Focus**

Finding single-digit products and related quotients is a required fluency for grade 3. Reaching fluency will take much of the year for many students. These skills and the understandings that support them are crucial; students will rely on them for years to come as they learn to multiply and divide with multidigit whole numbers and to add, subtract, multiply, and divide with fractions. After multiplication and division situations have been established, reasoning about patterns in products (e.g., products involving factors of 5 or 9) can help students remember particular products and quotients. Practice — and if necessary, extra support — should continue all year

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|                                 | for those who need it to attain fluency.  |
| <a href="#">MAFS.3.OA.4.8:</a>  | Solve two-step word problems using the four operations. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.   |
| <a href="#">MAFS.3.OA.4.9:</a>  | Identify arithmetic patterns (including patterns in the addition table or multiplication table), and explain them using properties of operations. <i>For example, observe that 4 times a number is always even, and explain why 4 times a number can be decomposed into two equal addends.</i>  |
| <a href="#">MAFS.3.NBT.1.1:</a> | Use place value understanding to round whole numbers to the nearest 10 or 100.  |
| <a href="#">MAFS.3.NBT.1.2:</a> | <p>Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b></p> <p>Students fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction. (Although 3.OA.3.7 and 3.NBT.1.2 are both fluency standards, these two standards do not represent equal investments of time in grade 3. Note that students in grade 2 were already adding and subtracting within 1000, just not fluently. That makes 3.NBT.1.2 a relatively small and incremental expectation. By contrast, multiplication and division are new in grade 3, and meeting the multiplication and division fluency standard 3.OA.3.7 with understanding is a major portion of students' work in grade 3.)</p> </div> |
| <a href="#">MAFS.3.NBT.1.3:</a> | Multiply one-digit whole numbers by multiples of 10 in the range 10–90 (e.g., $9 \times 80$ , $5 \times 60$ ) using strategies based on place value and properties of operations.   |
| <a href="#">MAFS.3.NF.1.1:</a>  | Understand a fraction $1/b$ as the quantity formed by 1 part when a whole is partitioned into $b$ equal parts; understand a fraction $a/b$ as the quantity formed by $a$ parts of size $1/b$ .  |
| <a href="#">MAFS.3.NF.1.2:</a>  | <p>Understand a fraction as a number on the number line; represent fractions on a number line diagram.</p> <p>a. Represent a fraction <math>1/b</math> on a number line diagram by defining the interval from 0 to 1 as the whole and partitioning it into <math>b</math> equal parts. Recognize that each part</p>   |

has size  $1/b$  and that the endpoint of the part based at 0 locates the number  $1/b$  on the number line.

- b. Represent a fraction  $a/b$  on a number line diagram by marking off  $a$  lengths  $1/b$  from 0. Recognize that the resulting interval has size  $a/b$  and that its endpoint locates the number  $a/b$  on the number line.

**Remarks/Examples:**

**Example of Opportunities for In-Depth Focus**

Developing an understanding of fractions as numbers is essential for future work with the number system. It is critical that students at this grade are able to place fractions on a number line diagram and understand them as a related component of their ever- expanding number system.

**Fluency Expectations or Examples of Culminating Standards**

Students fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction. 3.NBT.1.2 a relatively small and incremental expectation.

Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size.

- a. Understand two fractions as equivalent (equal) if they are the same size, or the same point on a number line.
- b. Recognize and generate simple equivalent fractions, e.g.,  $1/2 = 2/4$ ,  $4/6 = 2/3$ . Explain why the fractions are equivalent, e.g., by using a visual fraction model.
- c. Express whole numbers as fractions, and recognize fractions that are equivalent to whole numbers. *Examples: Express 3 in the form  $3 = 3/1$ ; recognize that  $6/1 = 6$ ; locate  $4/4$  and 1 at the same point of a number line diagram.*
- d. Compare two fractions with the same numerator or the same denominator by reasoning about their size. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with the symbols  $>$ ,  $=$ , or  $<$ , and justify the conclusions, e.g., by using a visual fraction model.

[MAFS.3.NF.1.3:](#)

[MAFS.3.MD.1.1:](#)

Tell and write time to the nearest minute and measure time

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|                                | intervals in minutes. Solve word problems involving addition and subtraction of time intervals in minutes, e.g., by representing the problem on a number line diagram.  |
| <a href="#">MAFS.3.MD.1.2:</a> | <p>Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l). Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:<br/>Examples of Opportunities for In-Depth Focus</b></p> <p>Continuous measurement quantities such as liquid volume, mass, and so on are an important context for fraction arithmetic (cf. 4.NF.2.4c, 5.NF.2.7c, 5.NF.2.3). In grade 3, students begin to get a feel for continuous measurement quantities and solve whole- number problems involving such quantities.</p> </div> |
| <a href="#">MAFS.3.MD.2.3:</a> | Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step “how many more” and “how many less” problems using information presented in scaled bar graphs. <i>For example, draw a bar graph in which each square in the bar graph might represent 5 pets.</i>   |
| <a href="#">MAFS.3.MD.2.4:</a> | Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units— whole numbers, halves, or quarters.  |
| <a href="#">MAFS.3.MD.3.5:</a> | <p>Recognize area as an attribute of plane figures and understand concepts of area measurement.</p> <ol style="list-style-type: none"> <li>a. A square with side length 1 unit, called “a unit square,” is said to have “one square unit” of area, and can be used to measure area.</li> <li>b. A plane figure which can be covered without gaps or overlaps by <math>n</math> unit squares is said to have an area of <math>n</math> square units.</li> </ol>  |
| <a href="#">MAFS.3.MD.3.6:</a> | Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units).   |
| <a href="#">MAFS.3.MD.3.7:</a> | <p>Relate area to the operations of multiplication and addition.</p> <ol style="list-style-type: none"> <li>a. Find the area of a rectangle with whole-number side lengths by tiling it, and show that the area is the same as would be found by multiplying the side lengths.</li> <li>b. Multiply side lengths to find areas of rectangles with</li> </ol>  |

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|                                       | <p>whole-number side lengths in the context of solving real world and mathematical problems, and represent whole-number products as rectangular areas in mathematical reasoning.</p> <p>c. Use tiling to show in a concrete case that the area of a rectangle with whole-number side lengths <math>a</math> and <math>b + c</math> is the sum of <math>a \times b</math> and <math>a \times c</math>. Use area models to represent the distributive property in mathematical reasoning.</p> <p>d. Recognize area as additive. Find areas of rectilinear figures by decomposing them into non-overlapping rectangles and adding the areas of the non-overlapping parts, applying this technique to solve real world problems.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>Remarks/Examples:</b><br/> <b>Examples of Opportunities for In-Depth Focus</b></p> <p>Area is a major concept within measurement, and area models must function as a support for multiplicative reasoning in grade 3 and beyond.</p> </div> |
| <p><a href="#">MAFS.3.MD.4.8:</a></p> | <p>Solve real world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.</p>   |
| <p><a href="#">MAFS.3.G.1.1:</a></p>  | <p>Understand that shapes in different categories (e.g., rhombuses, rectangles, and others) may share attributes (e.g., having four sides), and that the shared attributes can define a larger category (e.g., quadrilaterals). Recognize rhombuses, rectangles, and squares as examples of quadrilaterals, and draw examples of quadrilaterals that do not belong to any of these subcategories.</p>   |
| <p><a href="#">MAFS.3.G.1.2:</a></p>  | <p>Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole. <i>For example, partition a shape into 4 parts with equal area, and describe the area of each part as 1/4 of the area of the shape.</i></p>   |
| <p><a href="#">LAFS.3.W.1.2:</a></p>  | <p>Write informative/explanatory texts to examine a topic and convey ideas and information clearly.</p> <p>a. Introduce a topic and group related information together; include illustrations when useful to aiding comprehension.</p> <p>b. Develop the topic with facts, definitions, and details.</p> <p>c. Use linking words and phrases (e.g., also, another, and, more, but) to connect ideas within categories of information.</p>   |

|                                  |   |
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|                                  | d. Provide a concluding statement or section.   |
| <a href="#">LAFS.3.SL.1.1:</a>   | <p>Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 3 <i>topics and texts</i>, building on others' ideas and expressing their own clearly.</p> <ol style="list-style-type: none"> <li>a. Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion.</li> <li>b. Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion).</li> <li>c. Ask questions to check understanding of information presented, stay on topic, and link their comments to the remarks of others.</li> <li>d. Explain their own ideas and understanding in light of the discussion.</li> </ol>  |
| <a href="#">LAFS.3.SL.1.2:</a>   | Determine the main ideas and supporting details of a text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.   |
| <a href="#">LAFS.3.SL.1.3:</a>   | Ask and answer questions about information from a speaker, offering appropriate elaboration and detail.   |
| <a href="#">MAFS.K12.MP.1.1:</a> | <p><b>Make sense of problems and persevere in solving them.</b></p> <p>Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem.</p> |

Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

**Reason abstractly and quantitatively.**

[MAFS.K12.MP.2.1:](#)

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

**Construct viable arguments and critique the reasoning of others.**

[MAFS.K12.MP.3.1:](#)

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.



### **Model with mathematics.**

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another.

[MAFS.K12.MP.4.1:](#) Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

### **Use appropriate tools strategically.**

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

[MAFS.K12.MP.5.1:](#)

### **Attend to precision.**

[MAFS.K12.MP.6.1:](#)

Mathematically proficient students try to communicate precisely to

others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

**Look for and make use of structure.**

[MAFS.K12.MP.7.1:](#)

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

**Look for and express regularity in repeated reasoning.**

[MAFS.K12.MP.8.1:](#)

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

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| <a href="#">ELD.K12.ELL.1.1:</a>  | English language learners communicate for social and instructional purposes within the school setting.                                   |
| <a href="#">ELD.K12.ELL.AC.1:</a> | English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics. |

## **Mathematics - Grade Four (#5012060)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 5012060

**Abbreviated Title:** MATH GRADE FOUR

**Course Length:** Year (Y)

**Course Type:** Core

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 4

### **GENERAL NOTES**

MAFS.4

In Grade 4, instructional time should focus on three critical areas: (1) developing understanding and fluency with multi-digit multiplication, and developing understanding of dividing to find quotients involving multi-digit dividends; (2) developing an understanding of fraction equivalence, addition and subtraction of fractions with like denominators, and multiplication of fractions by whole numbers; (3) understanding that geometric figures can be analyzed and classified based on their properties, such as having parallel sides, perpendicular sides, particular angle measures, and symmetry.

(1) Students generalize their understanding of place value to 1,000,000, understanding the relative sizes of numbers in each place. They apply their understanding of models for multiplication (equal-sized groups, arrays, area models), place value, and properties of operations, in particular the distributive property, as they develop, discuss, and use efficient, accurate, and generalization methods to compute products of multi-digit whole numbers. Depending on the numbers and the context, they select and accurately apply appropriate methods to estimate or mentally calculate products. They develop fluency with efficient procedures for multiplying whole numbers; understand and explain why the procedures work based on place value and properties of operations; and use them to solve problems. Students apply their understanding of models for division, place value, properties of operations, and the relationship of division to multiplication as they develop, discuss, and use efficient, accurate, and generalization procedures to find quotients involving multi-digit dividends. They select and accurately apply appropriate methods to estimate and mentally calculate quotients, and interpret remainders based upon the context.

(2) Students develop understanding of fraction equivalence and operations with fractions. They recognize that two different fractions can be equal (e.g.,  $15/9 = 5/3$ ), and they develop methods for generating and recognizing equivalent fractions. Students extend previous understandings about how fractions are built from unit fractions, composing fractions from unit fractions, decomposing fractions into unit fractions, and

using the meaning of fractions and the meaning of multiplication to multiply a fraction by a whole number.

(3) Students describe, analyze, compare, and classify two-dimensional shapes. Through building, drawing, and analyzing two-dimensional shapes, students deepen their understanding of properties of two-dimensional objects and the use of them to solve problems involving symmetry.

**English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL’s need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

**COURSE STANDARDS**

| Name                           | Description   |
|--------------------------------|---|
| <a href="#">MAFS.4.OA.1.1:</a> | Interpret a multiplication equation as a comparison, e.g., interpret $35 = 5 \times 7$ as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations.        |
| <a href="#">MAFS.4.OA.1.2:</a> | Multiply or divide to solve word problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison.        |
| <a href="#">MAFS.4.OA.1.3:</a> | Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown |

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|                                 | quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.  |
| <a href="#">MAFS.4.OA.1.a:</a>  | Determine whether an equation is true or false by using comparative relational thinking. <i>For example, without adding 60 and 24, determine whether the equation <math>60 + 24 = 57 + 27</math> is true or false.</i>   |
| <a href="#">MAFS.4.OA.1.b:</a>  | Determine the unknown whole number in an equation relating four whole numbers using comparative relational thinking. <i>For example, solve <math>76 + 9 = n + 5</math> for <math>n</math> by arguing that nine is four more than five, so the unknown number must be four greater than 76.</i>   |
| <a href="#">MAFS.4.OA.2.4:</a>  | Investigate factors and multiples. <ul style="list-style-type: none"> <li>a. Find all factor pairs for a whole number in the range 1–100.</li> <li>b. Recognize that a whole number is a multiple of each of its factors. Determine whether a given whole number in the range 1–100 is a multiple of a given one-digit number.</li> <li>c. Determine whether a given whole number in the range 1–100 is prime or composite.</li> </ul> |
| <a href="#">MAFS.4.OA.3.5:</a>  | Generate a number or shape pattern that follows a given rule. Identify apparent features of the pattern that were not explicit in the rule itself. <i>For example, given the rule “Add 3” and the starting number 1, generate terms in the resulting sequence and observe that the terms appear to alternate between odd and even numbers. Explain informally why the numbers will continue to alternate in this way.</i>              |
| <a href="#">MAFS.4.NBT.1.1:</a> | Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right. <i>For example, recognize that <math>700 \div 70 = 10</math> by applying concepts of place value and division.</i>   |
| <a href="#">MAFS.4.NBT.1.2:</a> | Read and write multi-digit whole numbers using base-ten numerals, number names, and expanded form. Compare two multi-digit numbers based on meanings of the digits in each place, using $>$ , $=$ , and $<$ symbols to record the results of comparisons.  |
| <a href="#">MAFS.4.NBT.1.3:</a> | Use place value understanding to round multi-digit whole numbers to any place.   |
| <a href="#">MAFS.4.NBT.2.4:</a> | Fluently add and subtract multi-digit whole numbers using the standard algorithm.  |
|                                 | <p><b>Remarks/Examples:<br/>Fluency Expectations or Examples of Culminating Standards</b></p>  |

Students' work with decimals (4.NF.3.5–3.7) depends to some extent on concepts of fraction

Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

[MAFS.4.NBT.2.5:](#)

**Remarks/Examples:  
Examples of Opportunities for In-Depth Focus**

When students work toward meeting this standard, they combine prior understanding of multiplication with deepening understanding of the base-ten system of units to express the product of two multi-digit numbers as another multi-digit number. This work will continue in grade 5 and culminate in fluency with the standard algorithms in grade 6.

Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

[MAFS.4.NBT.2.6:](#)

**Remarks/Examples:  
Examples of Opportunities for In-Depth Focus**

When students work toward meeting this standard, they combine prior understanding of multiplication and division with deepening understanding of the base-ten system of units to find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors. This work will develop further in grade 5 and culminate in fluency with the standard algorithms in grade 6.

Explain why a fraction  $a/b$  is equivalent to a fraction  $(n \times a)/(n \times b)$  by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalent fractions.

[MAFS.4.NF.1.1:](#)

**Remarks/Examples:  
Examples of Opportunities for In-Depth Focus**

Extending fraction equivalence to the general case is necessary to extend arithmetic from whole numbers to fractions and decimals.

[MAFS.4.NF.1.2:](#)

Compare two fractions with different numerators and different denominators, e.g., by creating common denominators or numerators, or by comparing to a benchmark fraction such as  $1/2$ . Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with symbols  $>$ ,  $=$ , or  $<$ , and justify the conclusions, e.g., by using a visual fraction model.

[MAFS.4.NF.2.3:](#)

Understand a fraction  $a/b$  with  $a > 1$  as a sum of fractions  $1/b$ .

- a. Understand addition and subtraction of fractions as joining and separating parts referring to the same whole.
- b. Decompose a fraction into a sum of fractions with the same denominator in more than one way, recording each decomposition by an equation. Justify decompositions, e.g., by using a visual fraction model. *Examples:*  $3/8 = 1/8 + 1/8 + 1/8$ ;  $3/8 = 1/8 + 2/8$ ;  $2\ 1/8 = 1 + 1 + 1/8 = 8/8 + 8/8 + 1/8$ .
- c. Add and subtract mixed numbers with like denominators, e.g., by replacing each mixed number with an equivalent fraction, and/or by using properties of operations and the relationship between addition and subtraction.
- d. Solve word problems involving addition and subtraction of fractions referring to the same whole and having like denominators, e.g., by using visual fraction models and equations to represent the problem.

**Remarks/Examples:**

**Examples of Opportunities for In-Depth Focus**

This standard represents an important step in the multi-grade progression for addition and subtraction of fractions. Students extend their prior understanding of addition and subtraction to add and subtract fractions with like denominators by thinking of adding or subtracting so many unit fractions.

Apply and extend previous understandings of multiplication to multiply a fraction by a whole number.

[MAFS.4.NF.2.4:](#)

- a. Understand a fraction  $a/b$  as a multiple of  $1/b$ . *For example, use a visual fraction model to represent  $5/4$  as the product  $5 \times (1/4)$ , recording the conclusion by the equation  $5/4 = 5$*



$\times (1/4)$ .

- b. Understand a multiple of  $a/b$  as a multiple of  $1/b$ , and use this understanding to multiply a fraction by a whole number. *For example, use a visual fraction model to express  $3 \times (2/5)$  as  $6 \times (1/5)$ , recognizing this product as  $6/5$ . (In general,  $n \times (a/b) = (n \times a)/b$ .)*
- c. Solve word problems involving multiplication of a fraction by a whole number, e.g., by using visual fraction models and equations to represent the problem. *For example, if each person at a party will eat  $3/8$  of a pound of roast beef, and there will be 5 people at the party, how many pounds of roast beef will be needed? Between what two whole numbers does your answer lie?*

**Remarks/Examples:**

**Examples of Opportunities for In-Depth Focus**

This standard represents an important step in the multi-grade progression for multiplication and division of fractions. Students extend their developing understanding of multiplication to multiply a fraction by a whole number.

[MAFS.4.NF.3.5:](#)

Express a fraction with denominator 10 as an equivalent fraction with denominator 100, and use this technique to add two fractions with respective denominators 10 and 100. *For example, express  $3/10$  as  $30/100$ , and add  $3/10 + 4/100 = 34/100$ .*

[MAFS.4.NF.3.6:](#)

Use decimal notation for fractions with denominators 10 or 100. *For example, rewrite  $0.62$  as  $62/100$ ; describe a length as  $0.62$  meters; locate  $0.62$  on a number line diagram.*

[MAFS.4.NF.3.7:](#)

Compare two decimals to hundredths by reasoning about their size. Recognize that comparisons are valid only when the two decimals refer to the same whole. Record the results of comparisons with the symbols  $>$ ,  $=$ , or  $<$ , and justify the conclusions, e.g., by using a visual model.

[MAFS.4.MD.1.1:](#)

Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table. *For example, know that 1 ft is 12 times as long as 1 in. Express the length of a 4 ft snake as 48 in. Generate a conversion table for feet and inches listing the number pairs (1, 12), (2, 24), (3, 36), ...*

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| <a href="#">MAFS.4.MD.1.2:</a> | <p>Use the four operations to solve word problems<sup>1</sup> involving distances, intervals of time, and money, including problems involving simple fractions or decimals<sup>2</sup>. Represent fractional quantities of distance and intervals of time using linear models. (<sup>1</sup>See glossary <a href="#">Table 1</a> and <a href="#">Table 2</a>) (<sup>2</sup>Computational fluency with fractions and decimals is not the goal for students at this grade level.)</p>  |
| <a href="#">MAFS.4.MD.1.3:</a> | <p>Apply the area and perimeter formulas for rectangles in real world and mathematical problems. <i>For example, find the width of a rectangular room given the area of the flooring and the length, by viewing the area formula as a multiplication equation with an unknown factor.</i></p>  |
| <a href="#">MAFS.4.MD.2.4:</a> | <p>Make a line plot to display a data set of measurements in fractions of a unit (<math>\frac{1}{2}</math>, <math>\frac{1}{4}</math>, <math>\frac{1}{8}</math>). Solve problems involving addition and subtraction of fractions by using information presented in line plots. <i>For example, from a line plot find and interpret the difference in length between the longest and shortest specimens in an insect collection.</i></p>   |
| <a href="#">MAFS.4.MD.3.5:</a> | <p>Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement:</p> <ol style="list-style-type: none"> <li>a. An angle is measured with reference to a circle with its center at the common endpoint of the rays, by considering the fraction of the circular arc between the points where the two rays intersect the circle. An angle that turns through <math>\frac{1}{360}</math> of a circle is called a “one-degree angle,” and can be used to measure angles.</li> <li>b. An angle that turns through <math>n</math> one-degree angles is said to have an angle measure of <math>n</math> degrees.</li> </ol> |
| <a href="#">MAFS.4.MD.3.6:</a> | <p>Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure.</p>  |
| <a href="#">MAFS.4.MD.3.7:</a> | <p>Recognize angle measure as additive. When an angle is decomposed into non-overlapping parts, the angle measure of the whole is the sum of the angle measures of the parts. Solve addition and subtraction problems to find unknown angles on a diagram in real world and mathematical problems, e.g., by using an equation with a symbol for the unknown angle measure.</p>   |
| <a href="#">MAFS.4.G.1.1:</a>  | <p>Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.</p>  |
| <a href="#">MAFS.4.G.1.2:</a>  | <p>Classify two-dimensional figures based on the presence or absence</p>   |

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|                                | of parallel or perpendicular lines, or the presence or absence of angles of a specified size. Recognize right triangles as a category, and identify right triangles.   |
| <a href="#">MAFS.4.G.1.3:</a>  | Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts. Identify line-symmetric figures and draw lines of symmetry.   |
| <a href="#">LAFS.4.W.1.2:</a>  | <p>Write informative/explanatory texts to examine a topic and convey ideas and information clearly.</p> <ol style="list-style-type: none"> <li>Introduce a topic clearly and group related information in paragraphs and sections; include formatting (e.g., headings), illustrations, and multimedia when useful to aiding comprehension.</li> <li>Develop the topic with facts, definitions, concrete details, quotations, or other information and examples related to the topic.</li> <li>Link ideas within categories of information using words and phrases (e.g., <i>another, for example, also, because</i>).</li> <li>Use precise language and domain-specific vocabulary to inform about or explain the topic.</li> <li>Provide a concluding statement or section related to the information or explanation presented.</li> </ol>                    |
| <a href="#">LAFS.4.SL.1.1:</a> | <p>Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 4 <i>topics and texts</i>, building on others' ideas and expressing their own clearly.</p> <ol style="list-style-type: none"> <li>Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion.</li> <li>Follow agreed-upon rules for discussions and carry out assigned roles.</li> <li>Pose and respond to specific questions to clarify or follow up on information, and make comments that contribute to the discussion and link to the remarks of others.</li> <li>Review the key ideas expressed and explain their own ideas and understanding in light of the discussion.</li> </ol> |
| <a href="#">LAFS.4.SL.1.2:</a> | Paraphrase portions of a text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.  |
| <a href="#">LAFS.4.SL.1.3:</a> | Identify the reasons and evidence a speaker provides to support  |

particular points.

**Make sense of problems and persevere in solving them.**

[MAFS.K12.MP.1.1:](#)

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

**Reason abstractly and quantitatively.**

[MAFS.K12.MP.2.1:](#)

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

[MAFS.K12.MP.3.1:](#)

**Construct viable arguments and critique the reasoning of others.**

Mathematically proficient students understand and use stated

assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

**Model with mathematics.**

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another.

[MAFS.K12.MP.4.1:](#)

Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

**Use appropriate tools strategically.**

[MAFS.K12.MP.5.1:](#)

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a

calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

**Attend to precision.**

[MAFS.K12.MP.6.1:](#)

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

**Look for and make use of structure.**

[MAFS.K12.MP.7.1:](#)

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several

objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

**Look for and express regularity in repeated reasoning.**

[MAFS.K12.MP.8.1:](#)

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.AC.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.

## **Mathematics - Grade Five (#5012070)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 5012070

**Abbreviated Title:** MATH GRADE FIVE

**Course Length:** Year (Y)

**Course Type:** Core

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 5

### **GENERAL NOTES**

MAFS.5

In Grade 5, instructional time should focus on three critical areas: (1) developing fluency with addition and subtraction of fractions, and developing understanding of the multiplication of fractions and of division of fractions in limited cases (unit fractions divided by whole numbers and whole numbers divided by unit fractions); (2) extending division to 2-digit divisors, integrating decimal fractions into the place value system and developing understanding of operations with decimals to hundredths, and developing fluency with whole number and decimal operations; and (3) developing understanding of volume.

(1) Students apply their understanding of fractions and fraction models to represent the addition and subtraction of fractions with unlike denominators as equivalent calculations with like denominators. They develop fluency in calculating sums and differences of fractions, and make reasonable estimates of them. Students also use the meaning of fractions, of multiplication and division, and the relationship between multiplication and division to understand and explain why the procedures for multiplying and dividing fractions make sense. (Note: this is limited to the case of dividing unit fractions by whole numbers and whole numbers by unit fractions.)

(2) Students develop understanding of why division procedures work based on the meaning of base-ten numerals and properties of operations. They finalize fluency with multi-digit addition, subtraction, multiplication, and division. They apply their understandings of models for decimals, decimal notation, and properties of operations to add and subtract decimals to hundredths. They develop fluency in these computations, and make reasonable estimates of their results. Students use the relationship between decimals and fractions, as well as the relationship between finite decimals and whole numbers (i.e., a finite decimal multiplied by an appropriate power of 10 is a whole number), to understand and explain why the procedures for multiplying and dividing finite decimals make sense. They compute products and quotients of decimals to hundredths efficiently and accurately.



(3) Students recognize volume as an attribute of three-dimensional space. They understand that volume can be measured by finding the total number of same-size units of volume required to fill the space without gaps or overlaps. They understand that a 1-unit by 1-unit by 1-unit cube is the standard unit for measuring volume. They select appropriate units, strategies, and tools for solving problems that involve estimating and measuring volume. They decompose three-dimensional shapes and find volumes of right rectangular prisms by viewing them as decomposed into layers of arrays of cubes. They measure necessary attributes of shapes in order to determine volumes to solve real world and mathematical problems.

**English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL’s need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

**COURSE STANDARDS**

| Name                           | Description  |
|--------------------------------|--|
| <a href="#">MAFS.5.OA.1.1:</a> | Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.  |
| <a href="#">MAFS.5.OA.1.2:</a> | Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them. <i>For example, express the calculation “add 8 and 7, then multiply by 2” as <math>2 \times (8 + 7)</math>. Recognize that <math>3 \times (18932 + 921)</math> is three times as large as <math>18932 + 921</math>, without having to calculate the indicated sum or product.</i> |
| <a href="#">MAFS.5.OA.2.3:</a> | Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane. <i>For example, given the rule “Add 3” and the starting number 0, and given the rule</i>  |

*“Add 6” and the starting number 0, generate terms in the resulting sequences, and observe that the terms in one sequence are twice the corresponding terms in the other sequence. Explain informally why this is so.*

Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left.

[MAFS.5.NBT.1.1:](#)

**Remarks/Examples:  
Examples of Opportunities for In-Depth Focus**

The extension of the place value system from whole numbers to decimals is a major intellectual accomplishment involving understanding and skill with base-ten units and fractions.

[MAFS.5.NBT.1.2:](#)

Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10.

[MAFS.5.NBT.1.3:](#)

Read, write, and compare decimals to thousandths.

- a. Read and write decimals to thousandths using base-ten numerals, number names, and expanded form, e.g.,  $347.392 = 3 \times 100 + 4 \times 10 + 7 \times 1 + 3 \times (1/10) + 9 \times (1/100) + 2 \times (1/1000)$ .
- b. Compare two decimals to thousandths based on meanings of the digits in each place, using  $>$ ,  $=$ , and  $<$  symbols to record the results of comparisons.

[MAFS.5.NBT.1.4:](#)

Use place value understanding to round decimals to any place.

[MAFS.5.NBT.2.5:](#)

Fluently multiply multi-digit whole numbers using the standard algorithm.

**Remarks/Examples:  
Fluency Expectations or Examples of Culminating Standards**

5.NBT.2.5 Students fluently multiply multi-digit whole numbers using the standard algorithm.

[MAFS.5.NBT.2.6:](#)

Find whole-number quotients of whole numbers with up to four-

digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

**Remarks/Examples:  
Examples of Opportunities for In-Depth Focus**

The extension from one-digit divisors to two-digit divisors requires care. This is a major milestone along the way to reaching fluency with the standard algorithm in grade 6 (6.NS.2).

[MAFS.5.NBT.2.7:](#)

Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.

[MAFS.5.NF.1.1:](#)

Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators. *For example,  $2/3 + 5/4 = 8/12 + 15/12 = 23/12$ . (In general,  $a/b + c/d = (ad + bc)/bd$ .)*

[MAFS.5.NF.1.2:](#)

Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators, e.g., by using visual fraction models or equations to represent the problem. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers. *For example, recognize an incorrect result  $2/5 + 1/2 = 3/7$ , by observing that  $3/7 < 1/2$ .*

**Remarks/Examples:  
Examples of Opportunities for In-Depth Focus**

When students meet this standard, they bring together the threads of fraction equivalence (grades 3–5) and addition and subtraction (grades K–4) to fully extend addition and subtraction to fractions.

[MAFS.5.NF.2.3:](#)

Interpret a fraction as division of the numerator by the denominator ( $a/b = a \div b$ ). Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed

numbers, e.g., by using visual fraction models or equations to represent the problem. *For example, interpret  $\frac{3}{4}$  as the result of dividing 3 by 4, noting that  $\frac{3}{4}$  multiplied by 4 equals 3, and that when 3 wholes are shared equally among 4 people each person has a share of size  $\frac{3}{4}$ . If 9 people want to share a 50-pound sack of rice equally by weight, how many pounds of rice should each person get? Between what two whole numbers does your answer lie?*

[MAFS.5.NF.2.4:](#)

Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction.

- a. Interpret the product  $(\frac{a}{b}) \times q$  as a parts of a partition of  $q$  into  $b$  equal parts; equivalently, as the result of a sequence of operations  $a \times q \div b$ . *For example, use a visual fraction model to show  $(\frac{2}{3}) \times 4 = \frac{8}{3}$ , and create a story context for this equation. Do the same with  $(\frac{2}{3}) \times (\frac{4}{5}) = \frac{8}{15}$ . (In general,  $(\frac{a}{b}) \times (\frac{c}{d}) = \frac{ac}{bd}$ .)*
- b. Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths, and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles, and represent fraction products as rectangular areas.

**Remarks/Examples:  
Examples of Opportunities for In-Depth Focus**

When students meet this standard, they fully extend multiplication to fractions, making division of fractions in grade 6 (6.NS.1) a near target.

[MAFS.5.NF.2.5:](#)

Interpret multiplication as scaling (resizing), by:

- a. Comparing the size of a product to the size of one factor on the basis of the size of the other factor, without performing the indicated multiplication.
- b. Explaining why multiplying a given number by a fraction greater than 1 results in a product greater than the given number (recognizing multiplication by whole numbers greater than 1 as a familiar case); explaining why multiplying a given number by a fraction less than 1 results in a product smaller than the given number; and relating the principle of fraction equivalence  $\frac{a}{b} = \frac{(n \times a)}{(n \times b)}$  to the effect of multiplying  $\frac{a}{b}$  by 1.

|                                |  |
|--------------------------------|--|
| <a href="#">MAFS.5.NF.2.6:</a> | Solve real world problems involving multiplication of fractions and mixed numbers, e.g., by using visual fraction models or equations to represent the problem.  |
| <a href="#">MAFS.5.NF.2.7:</a> | <p>Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions.</p> <ol style="list-style-type: none"> <li>Interpret division of a unit fraction by a non-zero whole number, and compute such quotients. <i>For example, create a story context for <math>(1/3) \div 4</math>, and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that <math>(1/3) \div 4 = 1/12</math> because <math>(1/12) \times 4 = 1/3</math>.</i></li> <li>Interpret division of a whole number by a unit fraction, and compute such quotients. <i>For example, create a story context for <math>4 \div (1/5)</math>, and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that <math>4 \div (1/5) = 20</math> because <math>20 \times (1/5) = 4</math>.</i></li> <li>Solve real world problems involving division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions, e.g., by using visual fraction models and equations to represent the problem. <i>For example, how much chocolate will each person get if 3 people share <math>1/2</math> lb of chocolate equally? How many <math>1/3</math>-cup servings are in 2 cups of raisins?</i></li> </ol> |
| <a href="#">MAFS.5.MD.1.1:</a> | Convert among different-sized standard measurement units (i.e., km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec) within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems.  |
| <a href="#">MAFS.5.MD.2.2:</a> | Make a line plot to display a data set of measurements in fractions of a unit ( $1/2$ , $1/4$ , $1/8$ ). Use operations on fractions for this grade to solve problems involving information presented in line plots. <i>For example, given different measurements of liquid in identical beakers, find the amount of liquid each beaker would contain if the total amount in all the beakers were redistributed equally.</i>   |
| <a href="#">MAFS.5.MD.3.3:</a> | <p>Recognize volume as an attribute of solid figures and understand concepts of volume measurement.</p> <ol style="list-style-type: none"> <li>A cube with side length 1 unit, called a “unit cube,” is said to have “one cubic unit” of volume, and can be used to measure volume.</li> <li>A solid figure which can be packed without gaps or overlaps using <math>n</math> unit cubes is said to have a volume of <math>n</math>.</li> </ol>  |

|                                |   |
|--------------------------------|---|
|                                | cubic units.  |
| <a href="#">MAFS.5.MD.3.4:</a> | Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.   |
| <a href="#">MAFS.5.MD.3.5:</a> | <p>Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume.</p> <ol style="list-style-type: none"> <li>Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes, and show that the volume is the same as would be found by multiplying the edge lengths, equivalently by multiplying the height by the area of the base. Represent threefold whole-number products as volumes, e.g., to represent the associative property of multiplication.</li> <li>Apply the formulas <math>V = l \times w \times h</math> and <math>V = B \times h</math> for rectangular prisms to find volumes of right rectangular prisms with whole-number edge lengths in the context of solving real world and mathematical problems.</li> <li>Recognize volume as additive. Find volumes of solid figures composed of two non-overlapping right rectangular prisms by adding the volumes of the non-overlapping parts, applying this technique to solve real world problems.</li> </ol> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>Remarks/Examples:</b><br/> <b>Examples of Opportunities for In-Depth Focus</b></p> <p>Students work with volume as an attribute of a solid figure and as a measurement quantity. Students also relate volume to multiplication and addition. This work begins a progression leading to valuable skills in geometric measurement in middle school.</p> </div> |
| <a href="#">MAFS.5.G.1.1:</a>  | Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x-axis and x-coordinate, y-axis and y-coordinate).  |
| <a href="#">MAFS.5.G.1.2:</a>  | Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.   |

[MAFS.5.G.2.3:](#)

Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category. *For example, all rectangles have four right angles and squares are rectangles, so all squares have four right angles.*

[MAFS.5.G.2.4:](#)

Classify and organize two-dimensional figures into Venn diagrams based on the attributes of the figures.

Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

[LAFS.5.W.1.2:](#)

- a. Introduce a topic clearly, provide a general observation and focus, and group related information logically; include formatting (e.g., headings), illustrations, and multimedia when useful to aiding comprehension.
- b. Develop the topic with facts, definitions, concrete details, quotations, or other information and examples related to the topic.
- c. Link ideas within and across categories of information using words, phrases, and clauses (e.g., in contrast, especially).
- d. Use precise language and domain-specific vocabulary to inform about or explain the topic.
- e. Provide a concluding statement or section related to the information or explanation presented.

[LAFS.5.SL.1.1:](#)

Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 5 topics and texts*, building on others' ideas and expressing their own clearly.

- a. Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion.
- b. Follow agreed-upon rules for discussions and carry out assigned roles.
- c. Pose and respond to specific questions by making comments that contribute to the discussion and elaborate on the remarks of others.
- d. Review the key ideas expressed and draw conclusions in light of information and knowledge gained from the discussions.

[LAFS.5.SL.1.2:](#)

Summarize a written text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.

|                                  |   |
|----------------------------------|---|
| <a href="#">LAFS.5.SL.1.3:</a>   | Summarize the points a speaker makes and explain how each claim is supported by reasons and evidence.   |
| <a href="#">MAFS.K12.MP.1.1:</a> | <p><b>Make sense of problems and persevere in solving them.</b></p> <p>Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.</p> |
| <a href="#">MAFS.K12.MP.2.1:</a> | <p><b>Reason abstractly and quantitatively.</b></p> <p>Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.</p>  |
| <a href="#">MAFS.K12.MP.3.1:</a> | <p><b>Construct viable arguments and critique the reasoning of others.</b></p>  |



Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

**Model with mathematics.**

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another.

[MAFS.K12.MP.4.1:](#)

Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

**Use appropriate tools strategically.**

[MAFS.K12.MP.5.1:](#)

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include

pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

**Attend to precision.**

[MAFS.K12.MP.6.1:](#)

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

**Look for and make use of structure.**

[MAFS.K12.MP.7.1:](#)

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic

expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

**Look for and express regularity in repeated reasoning.**

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

[MAFS.K12.MP.8.1:](#)

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.AC.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.

## Advanced Topics in Mathematics (formerly 129830A) (#1298310)

**Version for Academic Year:** 2015 - 2016

**Course Number:** 1298310

**Abbreviated Title:** ADV TOPICS IN MATH

**Number of Credits:** One credit (1)

**Course Length:** Year (Y)

**Course Level:** 2

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 9,10,11,12

### GENERAL NOTES

#### English Language Development ELD Standards Special Notes Section:

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

### COURSE STANDARDS

| Name                               | Description   |
|------------------------------------|---|
| <a href="#">MAFS.912.N-CN.1.3:</a> | Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.   |
| <a href="#">MAFS.912.N-CN.2.4:</a> | Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number. |
| <a href="#">MAFS.912.N-CN.2.5:</a> | Represent addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the complex plane; use properties of this representation for computation. For example,                               |

|                                     |  |
|-------------------------------------|--|
|                                     | $(-1 + \sqrt{3}i)^3 = 8$ because $(-1 + \sqrt{3}i)$ has modulus 2 and argument $120^\circ$ .   |
| <a href="#">MAFS.912.N-CN.2.6:</a>  | Calculate the distance between numbers in the complex plane as the modulus of the difference, and the midpoint of a segment as the average of the numbers at its endpoints.  |
| <a href="#">MAFS.912.N-CN.3.7:</a>  | Solve quadratic equations with real coefficients that have complex solutions.  |
| <a href="#">MAFS.912.N-CN.3.8:</a>  | Extend polynomial identities to the complex numbers. <i>For example, rewrite <math>x^2 + 4</math> as <math>(x + 2i)(x - 2i)</math>.</i>  |
| <a href="#">MAFS.912.N-CN.3.9:</a>  | Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.   |
| <a href="#">MAFS.912.N-VM.3.6:</a>  | Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network.   |
| <a href="#">MAFS.912.N-VM.3.7:</a>  | Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled.  |
| <a href="#">MAFS.912.N-VM.3.8:</a>  | Add, subtract, and multiply matrices of appropriate dimensions.  |
| <a href="#">MAFS.912.N-VM.3.9:</a>  | Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties.  |
| <a href="#">MAFS.912.N-VM.3.10:</a> | Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse.     |
| <a href="#">MAFS.912.N-VM.3.11:</a> | Multiply a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector. Work with matrices as transformations of vectors.   |
| <a href="#">MAFS.912.N-VM.3.12:</a> | Work with $2 \times 2$ matrices as transformations of the plane, and interpret the absolute value of the determinant in terms of area.   |
| <a href="#">MAFS.912.A-REI.3.8:</a> | Represent a system of linear equations as a single matrix equation in a vector variable.   |
| <a href="#">MAFS.912.A-REI.3.9:</a> | Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension $3 \times 3$ or greater).  |
|                                     | Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★  |
| <a href="#">MAFS.912.F-IF.3.7:</a>  | <ol style="list-style-type: none"> <li>Graph linear and quadratic functions and show intercepts, maxima, and minima.</li> <li>Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.</li> </ol> |

- c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.
- d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.
- e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.

[MAFS.912.F-IF.3.8:](#)

Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

- a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
- b. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as  $y = (1.02)^t$ ,  $y = (0.97)^t$ ,  $y = (1.07)^{2t}$ ,  $y = (1.2)^{t/10}$ , and classify them as representing exponential growth or decay.*

[MAFS.912.F-IF.3.9:](#)

Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*

[MAFS.912.F-BF.1.1:](#)

Write a function that describes a relationship between two quantities. ★

- a. Determine an explicit expression, a recursive process, or steps for calculation from a context.
- b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*
- c. Compose functions. *For example, if  $T(y)$  is the temperature in the atmosphere as a function of height, and  $h(t)$  is the height of a weather balloon as a function*

|                                    |   |
|------------------------------------|---|
|                                    | <i>of time, then <math>T(h(t))</math> is the temperature at the location of the weather balloon as a function of time.</i>  |
| <a href="#">MAFS.912.F-BF.1.2:</a> | Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. ★  |
| <a href="#">MAFS.912.F-BF.2.3:</a> | Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$ , $k f(x)$ , $f(kx)$ , and $f(x + k)$ for specific values of $k$ (both positive and negative); find the value of $k$ given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. <i>Include recognizing even and odd functions from their graphs and algebraic expressions for them.</i>   |
| <a href="#">MAFS.912.F-BF.2.4:</a> | Find inverse functions. <ul style="list-style-type: none"> <li>a. Solve an equation of the form <math>f(x) = c</math> for a simple function <math>f</math> that has an inverse and write an expression for the inverse. <i>For example, <math>f(x) = 2x^3</math> or <math>f(x) = (x+1)/(x-1)</math> for <math>x \neq 1</math>.</i></li> <li>b. Verify by composition that one function is the inverse of another.</li> <li>c. Read values of an inverse function from a graph or a table, given that the function has an inverse.</li> <li>d. Produce an invertible function from a non-invertible function by restricting the domain.</li> </ul> |
| <a href="#">MAFS.912.F-BF.2.5:</a> | Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.  |
| <a href="#">MAFS.912.F-TF.1.3:</a> | Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$ , $\pi/4$ and $\pi/6$ , and use the unit circle to express the values of sine, cosine, and tangent for $\pi-x$ , $\pi+x$ , and $2\pi-x$ in terms of their values for $x$ , where $x$ is any real number.   |
| <a href="#">MAFS.912.F-TF.1.4:</a> | Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.  |
| <a href="#">MAFS.912.F-TF.2.5:</a> | Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline. ★  |
| <a href="#">MAFS.912.F-TF.2.6:</a> | Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.  |
| <a href="#">MAFS.912.F-TF.2.7:</a> | Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context. ★  |

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| <a href="#">MAFS.912.F-TF.3.8:</a>  | Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to calculate trigonometric ratios.   |
| <a href="#">MAFS.912.F-TF.3.9:</a>  | Prove the addition and subtraction, half-angle, and double-angle formulas for sine, cosine, and tangent and use these formulas to solve problems.  |
| <a href="#">MAFS.912.G-GPE.1.1:</a> | Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.  |
| <a href="#">MAFS.912.G-GPE.1.2:</a> | Derive the equation of a parabola given a focus and directrix.   |
| <a href="#">MAFS.912.G-GPE.1.3:</a> | Derive the equations of ellipses and hyperbolas given the foci and directrices.  |
| <a href="#">MAFS.912.G-GMD.1.1:</a> | Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. <i>Use dissection arguments, Cavalieri's principle, and informal limit arguments.</i>   |
| <a href="#">MAFS.912.G-GMD.1.2:</a> | Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.   |
| <a href="#">MAFS.912.S-CP.2.6:</a>  | Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model. ★   |
| <a href="#">MAFS.912.S-CP.2.7:</a>  | Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ , and interpret the answer in terms of the model. ★  |
| <a href="#">MAFS.912.S-CP.2.8:</a>  | Apply the general Multiplication Rule in a uniform probability model, $P(A \text{ and } B) = P(A)P(B A) = P(B)P(A B)$ , and interpret the answer in terms of the model. ★  |
| <a href="#">MAFS.912.S-CP.2.9:</a>  | Use permutations and combinations to compute probabilities of compound events and solve problems. ★  |
| <a href="#">MAFS.912.S-MD.1.1:</a>  | Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions. ★  |
| <a href="#">MAFS.912.S-MD.1.2:</a>  | Calculate the expected value of a random variable; interpret it as the mean of the probability distribution. ★   |
| <a href="#">MAFS.912.S-MD.1.3:</a>  | Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. <i>For example, find the theoretical probability distribution for the number of correct answers obtained by guessing on all five questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes.</i> ★ |
| <a href="#">MAFS.912.S-MD.1.4:</a>  | Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned  |



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|                                    | empirically; find the expected value. <i>For example, find a current data distribution on the number of TV sets per household in the United States, and calculate the expected number of sets per household. How many TV sets would you expect to find in 100 randomly selected households?</i> ★   |
| <a href="#">MAFS.912.S-MD.2.5:</a> | Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values. ★<br><br>a. Find the expected payoff for a game of chance. <i>For example, find the expected winnings from a state lottery ticket or a game at a fast-food restaurant.</i><br>b. Evaluate and compare strategies on the basis of expected values. <i>For example, compare a high-deductible versus a low-deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident.</i>  |
| <a href="#">MAFS.912.S-MD.2.6:</a> | Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator). ★  |
| <a href="#">MAFS.912.S-MD.2.7:</a> | Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game). ★   |
| <a href="#">LAFS.910.SL.1.1:</a>   | Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.<br><br>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.<br>b. Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed.<br>c. Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.<br>d. Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the |

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|                                     | evidence and reasoning presented.  |
| <a href="#">LAFS.910.SL.1.2:</a>    | Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.   |
| <a href="#">LAFS.910.SL.1.3:</a>    | Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.  |
| <a href="#">LAFS.910.SL.2.4:</a>    | Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.  |
| <a href="#">LAFS.1112.RST.1.3:</a>  | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.  |
| <a href="#">LAFS.1112.RST.2.4:</a>  | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.   |
| <a href="#">LAFS.1112.RST.3.7:</a>  | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.  |
| <a href="#">LAFS.1112.WHST.1.1:</a> | <p>Write arguments focused on <i>discipline-specific content</i>.</p> <ol style="list-style-type: none"> <li>a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.</li> <li>b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience’s knowledge level, concerns, values, and possible biases.</li> <li>c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.</li> <li>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.</li> </ol> |

- e. Provide a concluding statement or section that follows from or supports the argument presented.

Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

[LAFS.1112.WHST.1.2:](#)

- a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.
- b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience’s knowledge of the topic.
- c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.
- d. Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.
- e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic).

[LAFS.1112.WHST.2.4:](#)

Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

[LAFS.1112.WHST.3.9:](#)

Draw evidence from informational texts to support analysis, reflection, and research.

**Make sense of problems and persevere in solving them.**

[MAFS.K12.MP.1.1:](#)

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider

analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

**Reason abstractly and quantitatively.**

[MAFS.K12.MP.2.1:](#)

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

**Construct viable arguments and critique the reasoning of others.**

[MAFS.K12.MP.3.1:](#)

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient

students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

**Model with mathematics.**

[MAFS.K12.MP.4.1:](#)

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

**Use appropriate tools strategically.**

[MAFS.K12.MP.5.1:](#)

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical

knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

[MAFS.K12.MP.6.1:](#)

**Attend to precision.**

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

[MAFS.K12.MP.7.1:](#)

**Look for and make use of structure.**

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

[MAFS.K12.MP.8.1:](#)

**Look for and express regularity in repeated reasoning.**

Mathematically proficient students notice if calculations are

|  |  |
|--|--|
|  | <p>repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation <math>(y - 2)/(x - 1) = 3</math>. Noticing the regularity in the way terms cancel when expanding <math>(x - 1)(x + 1)</math>, <math>(x - 1)(x^2 + x + 1)</math>, and <math>(x - 1)(x^3 + x^2 + x + 1)</math> might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.</p> |
| <p><a href="#">ELD.K12.ELL.1.1:</a></p>  | <p>English language learners communicate for social and instructional purposes within the school setting.</p>  |
| <p><a href="#">ELD.K12.ELL.AC.1:</a></p> | <p>English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.</p>  |

# Advanced Algebra with Financial Applications (#1200500)

**Version for Academic Year:** 2015 - 2016

**Course Number:** 1200500

**Abbreviated Title:** ADV ALG W/FIN APP

**Number of Credits:** One credit (1)

**Course Length:** Year (Y)

**Course Type:** Core

**Course Level:** 2

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 9,10,11,12

## GENERAL NOTES

### English Language Development ELD Standards Special Notes Section:

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

## COURSE STANDARDS

| Name                          | Description  |
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| <a href="#">MA.912.F.1.1:</a> | Explain the difference between simple and compound interest.<br><b>Remarks/Examples:</b><br>Example: Compare the similarities and differences for calculating the final amount of money in your savings account based on simple interest or compound interest. |
| <a href="#">MA.912.F.1.2:</a> | Solve problems involving compound interest.  |



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|                                      | <p><b>Remarks/Examples:</b><br/> Example: Find the amount of money on deposit at the end of 5 years if you started with \$500 and it was compounded quarterly at 6 % interest. Example: Joe won \$25,000 in the lottery. How many years will it take at 6% interest compounded yearly for his money to double?</p>  |
| <p><a href="#">MA.912.F.1.3:</a></p> | <p>Demonstrate the relationship between simple interest and linear growth.</p> <p><b>Remarks/Examples:</b><br/> Example: Find the account balance at the end of each month for a 5 month span for \$1500 @ 3 % interest based on simple interest for 1 year. Graph this scenario and explain if this is a linear or exponential problem.</p>  |
| <p><a href="#">MA.912.F.1.4:</a></p> | <p>Demonstrate the relationship between compound interest and exponential growth.</p> <p><b>Remarks/Examples:</b><br/> Example: Using an exponential function, find the account balance at the end of 4 years if you deposited \$1300 in an account paying 3.5% interest compounded annually. Graph the scenario.</p>   |
| <p><a href="#">MA.912.F.2.1:</a></p> | <p>Calculate the future value of a given amount of money with and without technology.</p> <p><b>Remarks/Examples:</b><br/> Example: Suppose you have \$750 on January 1, 2007. If you deposit this in an account paying 5% interest, compounded quarterly, how much money will be in the account on January 1, 2012? Example: Suppose you deposit \$400 into an account at the beginning of each year, starting Jan 1, 2007. If the account pays 6% interest, compounded annually, how much will be in the account at the end of 5 years?</p> |
| <p><a href="#">MA.912.F.2.2:</a></p> | <p>Calculate the present value of a certain amount of money for a given length of time in the future with and without technology.</p> <p><b>Remarks/Examples:</b><br/> Example: A five year, zero-coupon bond pays 5% annual interest, and has a face value of \$1,000. If the bond matures on Dec 31, 2010, what was the original purchase price of the bond? Example: Find the present value of an annuity paying \$500 per year for 10 years at 6% annual interest.</p>  |

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| <p><a href="#">MA.912.F.3.1:</a></p> | <p>Compare the advantages and disadvantages of using cash versus a credit card.</p> <p><b>Remarks/Examples:</b><br/> Example: Compare paying for a tank of gasoline in cash or paying with a credit card over a period of time.</p>  |
| <p><a href="#">MA.912.F.3.2:</a></p> | <p>Analyze credit scores and reports.</p> <p><b>Remarks/Examples:</b><br/> Example: Explain how each of the following categories affects a credit score: 1) past payment history, 2) amount of debt, 3) public records information, 4) length of credit history, and 5) the number of recent credit inquiries.</p>   |
| <p><a href="#">MA.912.F.3.3:</a></p> | <p>Calculate the finance charges and total amount due on a credit card bill.</p> <p><b>Remarks/Examples:</b><br/> Example: Calculate the finance charge each month and the total amount paid for 5 months if you charged \$500 on your credit card but you can only afford to pay \$100 each month. Your credit card has a monthly periodic finance rate of .688% and an annual finance rate of 8.9%.</p>  |
| <p><a href="#">MA.912.F.3.4:</a></p> | <p>Compare the advantages and disadvantages of deferred payments.</p> <p><b>Remarks/Examples:</b><br/> Example: Compare paying on a college loan between a Stafford loan or a PLUS loan two years after graduation</p>   |
| <p><a href="#">MA.912.F.3.5:</a></p> | <p>Calculate deferred payments.</p> <p><b>Remarks/Examples:</b><br/> Example: You want to buy a sofa that cost \$899. Company A will let you pay \$100 down and then pay the remaining amount over 3 years at 22% interest. Company B will not make you pay a down payment and they will defer payments for one year. However, you will accrue interest at a rate of 20 % interest during that first year. Starting the second year you will have to pay the new amount for 2 years at a rate of 26 % interest. Which deal is better and why? Calculate the total amount paid for both deals. Example: An electronics company advertises that you don't have to pay anything for 2 years. If you bought a big screen TV for \$2999 on January 1st what would your balance be two years later if you haven't made any payments assuming an interest rate of 23.99%?</p> |

What would your monthly payments be to pay the TV off in 2 years? What did the TV really cost you?

Calculate total cost of purchasing consumer durables over time given different down payments, financing options, and fees.

[MA.912.F.3.6:](#)

**Remarks/Examples:**

Example: Find the actual cost of a car and interest charged with a showroom price of \$15,999, down payment of \$1,600, rate of interest of 12%, and 30 monthly payments.

Calculate the following fees associated with a mortgage:

- discount points
- origination fee
- maximum brokerage fee on a net or gross loan
- documentary stamps
- prorated expenses (interest, county and/or city property taxes, and mortgage on an assumed mortgage)

[MA.912.F.3.7:](#)

**Remarks/Examples:**

Example:

1) Calculate the total amount of fees on a \$230,000 mortgage if the lender: charges 2 points and a 0.5% origination fee.

2) Calculate the maximum brokerage fee on a net loan of \$184,000,

3) A seller has agreed to pay the Documentary Stamps on a property worth \$150,000 (selling price). The purchaser is responsible for the Documentary Stamps on the \$75,000 mortgage being assumed and the new \$25,000 second mortgage. Calculate all applicable amounts.

4) A \$185,340 loan carries at a 5.625% annual interest rate. Using the 365 day method, how much interest would a buyer owe for the 22 days remaining for a May closing.

Calculate the total amount to be paid over the life of a fixed rate loan.

[MA.912.F.3.9:](#)

**Remarks/Examples:**

Example: Calculate the total amount to be paid for a \$275,000 loan at 5.75% interest over 30 years

[MA.912.F.3.10:](#)

Calculate the effects on the monthly payment in the change of interest rate based on an adjustable rate mortgage.

**Remarks/Examples:**

Example: You would like to borrow \$245,000 using a 30-year, 1-year ARM indexed to the 1-year Treasury security with a 2.75 percent margin and 2/6 caps (2 percent per year and 6 percent lifetime). The initial interest rate on this loan is 2.75 percent. The lender is charging you 1.50 points and \$1,200 in miscellaneous fees to close the loan.

- a) What is the initial payment on this mortgage?
- b) If the 1- year Treasury security is yielding 2.25 percent at the first adjustment date, what is your payment on this loan during the second year?
- c) Suppose that the 1-year Treasury is yielding 2.75 percent at the second adjustment date. What is the new payment on this loan during the third year?
- d) Assuming that you pay of the loan at the end of the third year, what yield did the lender earn on this loan?

Now resolve all four parts of the last problem assuming that the loan has a 20 percent payment cap instead of 2/6 interest rate caps.

- a) What is the initial payment on this mortgage?
- b) If the 1- year Treasury security is yielding 2.25 percent at the first adjustment date, what is your payment on this loan during the second year?
- c) Suppose that the 1-year Treasury is yielding 2.75 percent at the second adjustment date. What is the new payment on this loan during the third year?
- d) Assuming that you pay of the loan at the end of the third year, what yield did the lender earn on this loan?

Calculate the final pay out amount for a balloon mortgage.

[MA.912.F.3.11:](#)

**Remarks/Examples:**

Example: If you have a 5-year balloon mortgage with a 15 year amortization schedule, a rate of 6.5%, and a \$100,000 loan what would the remaining balance be after the end of the fifth year?

Compare the cost of paying a higher interest rate and lower points versus a lower interest rate and more points.

[MA.912.F.3.12:](#)

**Remarks/Examples:**

Example: Assuming all of the following were originally 15

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|                                       | <p>year mortgages, which fixed rate mortgage cost the mortgagor the least?</p> <p>a) 7.375% interest + 0 points paid off in 10 years<br/> b) 7.375% interest + 0 points paid off in 7 years<br/> c) 7 % interest + 3 points paid off in 10 years<br/> d) 7 % interest + 3 points paid off in 7 years</p>   |
| <p><a href="#">MA.912.F.3.13:</a></p> | <p>Calculate the total amount paid for the life of a loan for a house including the down payment, points, fees, and interest.</p> <p><b>Remarks/Examples:</b><br/> Example: Calculate the total amount paid for a \$100,000 house with a 15 year fixed rate loan at 5.65% if the mortgagor pays a \$25,000 down payment 2 points 1% origination fee maximum brokerage fee on a net loan and State Documentary Stamps on the deed at a tax rate of \$.70 per \$100, the mortgage note at a tax rate of \$.35 per \$100, a and Intangible Tax at a rate of .002.</p>                           |
| <p><a href="#">MA.912.F.3.14:</a></p> | <p>Compare the total cost for a set purchase price using a fixed rate, adjustable rate, and a balloon mortgage.</p> <p><b>Remarks/Examples:</b><br/> Example: Find the total cost for a \$225,000 mortgage for the following options:</p> <p>a) 30 year fixed rate mortgage with a rate of 6.35 %<br/> b) 3/1 ARM with a rate of 6.75% with a maximum adjustment of 2 points per year with a cap of 6 points for 30 years c) 10 year balloon mortgage with a 30 year amortization schedule with a rate of 5.5%</p> <p>Next describe the benefits and detriments of each mortgage option.</p> |
| <p><a href="#">MA.912.F.3.17:</a></p> | <p>Compare interest rate calculations and annual percentage rate calculations to distinguish between the two rates.</p>  |
| <p><a href="#">MA.912.F.4.1:</a></p>  | <p>Develop personal budgets that fit within various income brackets.</p> <p><b>Remarks/Examples:</b><br/> Example: Develop a budget worksheet that includes typical expenses such as housing, transportation, utilities, food, medical expenses, and miscellaneous expenses. Add categories for savings toward your own financial goals, and determine the monthly income needed, before taxes, to meet</p>  |

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|                               | the requirements of your budget.  |
| <a href="#">MA.912.F.4.2:</a> | <p>Explain cash management strategies including debit accounts, checking accounts, and savings accounts.</p> <p><b>Remarks/Examples:</b><br/> Example: Explain the difference between a checking account and a savings account. Why might you want to have both types of accounts? Why might you want to have only one or the other type? Why is it rare to find someone who has a savings account but no checking account?</p> |
| <a href="#">MA.912.F.4.3:</a> | <p>Calculate net worth.</p> <p><b>Remarks/Examples:</b><br/> Example: Jose is trying to prepare a balance sheet for the end of the year. His balances and details for the year are given in the table below. Write a balance sheet of Jose's liabilities and assets, and compute his net worth.</p>   |
| <a href="#">MA.912.F.4.4:</a> | <p>Establish a plan to pay off debt.</p> <p><b>Remarks/Examples:</b><br/> Example: Suppose you currently have a balance of \$4500 on a credit card that charges 18% annual interest. What monthly payment would you have to make in order to pay off the card in 3 years, assuming you do not make any more charges to the card?</p>  |
| <a href="#">MA.912.F.4.5:</a> | <p>Develop and apply a variety of strategies to use tax tables, and to determine, calculate, and complete yearly federal income tax.</p> <p><b>Remarks/Examples:</b><br/> Example: Suppose that Joe had income of \$40,000 in 2005, and had various deductions totaling \$6,240. If Joe filed as a single person, how much income tax did he have to pay that year?</p>   |
| <a href="#">MA.912.F.4.6:</a> | <p>Compare different insurance options and fees.</p> <p>Compare and contrast the role of insurance as a device to mitigate risk and calculate expenses of various options.</p>  |
| <a href="#">MA.912.F.4.7:</a> | <p><b>Remarks/Examples:</b><br/> Example: Explain why a person might choose to buy life insurance. Are there any circumstances under which one might not want life insurance?</p>   |

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| <p><a href="#">MA.912.F.4.8:</a></p>  | <p>Collect, organize, and interpret data to determine an effective retirement savings plan to meet personal financial goals.</p> <p><b>Remarks/Examples:</b><br/> Example: Investigate historical rates of return for stocks, bonds, savings accounts, mutual funds, as well as the relative risks for each type of investment. Organize your results in a table showing the relative returns and risks of each type of investment over short and long terms, and use these data to determine a combination of investments suitable for building a retirement account sufficient to meet anticipated financial needs.</p>   |
| <p><a href="#">MA.912.F.4.9:</a></p>  | <p>Calculate, compare, and contrast different types of retirement plans, including IRAs, ROTH accounts, and annuities.</p> <p><b>Remarks/Examples:</b><br/> Example: Suppose you put \$5000 per year into an IRA for 40 years. If the account pays 6% per year interest, how much would you have at the end of the 40 years? If, at that time, you are in the 15% income tax bracket, how much would this be after taxes?</p> <p>Suppose that, instead, you paid the tax each year on the \$5000 at your current rate of 28% and put the remaining funds in a ROTH account paying 6% interest. How much would you then have after 40 years?</p> <p>Which appears to be the better option? What are some of the risks of deferring tax payments until retirement?</p> <p>Example: Explain the difference between an Individual Retirement Account (IRA) and a ROTH account.</p> <p>Why might somebody choose to put retirement funds in a ROTH account rather than an IRA?</p> |
| <p><a href="#">MA.912.F.4.10:</a></p> | <p>Analyze diversification in investments.</p>  |
| <p><a href="#">MA.912.F.4.11:</a></p> | <p>Purchase stock with a set amount of money, and follow the process through gains, losses, and selling.</p> <p><b>Remarks/Examples:</b><br/> Example: At the beginning of the year, Mary invests \$3000, buying \$1500 of Stock A at \$30 per share, \$1000 of Stock B at \$40 per share, and putting \$500 in a money market account paying 5% interest. At the end of the year, stock A is priced</p>  |

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|  | <p>at \$34 per share, and stock B is priced at \$38 per share. What is the overall rate of return for the year on Mary's investments?</p>   |
| <p><a href="#">MA.912.F.4.12:</a></p>      | <p>Compare and contrast income from purchase of common stock, preferred stock, and bonds.</p> <p><b>Remarks/Examples:</b><br/>         Example: Explain the difference between common and preferred stock. What are some reasons people might choose common stock over preferred stock? Which type of stock is more prevalent in the market today?</p> <p>Example: Compare corporate bonds, government bonds, and common stock as investments with respect to the following attributes: rates of return, price risk, default risk, and taxability of earnings</p> |
| <p><a href="#">MA.912.F.4.13:</a></p>      | <p>Given current exchange rates be able to convert from one form of currency to another.</p> <p><b>Remarks/Examples:</b><br/>         Example: Suppose you are traveling in Europe, and while there you withdraw 150 Euros to pay for expenses. If the exchange rate at the time was \$1.27 per Euro, how much money (in dollars) was charged to your bank account?</p>   |
| <p><a href="#">MAFS.912.A-SSE.1.1:</a></p> | <p>Interpret expressions that represent a quantity in terms of its context. ★</p> <ol style="list-style-type: none"> <li>Interpret parts of an expression, such as terms, factors, and coefficients.</li> <li>Interpret complicated expressions by viewing one or more of their parts as a single entity. <i>For example,</i><br/>           interpret <math>P(1+r)^n</math> as the product of <math>P</math> and a factor not depending on <math>P</math>.</li> </ol>  |
| <p><a href="#">MAFS.912.A-SSE.2.4:</a></p> | <p>Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. <i>For example, calculate mortgage payments.</i> ★</p>  |
| <p><a href="#">MAFS.912.A-CED.1.1:</a></p> | <p>Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational, absolute, and exponential functions. ★</p>   |



[MAFS.912.A-CED.1.2:](#)

Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. ★

[MAFS.912.A-CED.1.3:](#)

Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.* ★

[MAFS.912.A-CED.1.4:](#)

Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law  $V = IR$  to highlight resistance  $R$ .* ★

[MAFS.912.A-REL.3.8:](#)

Represent a system of linear equations as a single matrix equation in a vector variable.

[MAFS.912.A-REL.3.9:](#)

Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension  $3 \times 3$  or greater).

[MAFS.912.F-IF.2.4:](#)

For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.* ★

[MAFS.912.F-IF.2.5:](#)

Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function  $h(n)$  gives the number of person-hours it takes to assemble engines in a factory, then the positive integers would be an appropriate domain for the function.* ★

[MAFS.912.F-IF.2.6:](#)

Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. ★

[MAFS.912.F-IF.3.7:](#)

Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★

- a. Graph linear and quadratic functions and show intercepts, maxima, and minima.
- b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
- c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.

- d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.
- e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.

[MAFS.912.F-IF.3.8:](#)

Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

- a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
- b. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as  $y = (1.02)^t$ ,  $y = (0.97)^t$ ,  $y = (1.01)^{2t}$ ,  $y = (1.2)^{t/10}$ , and classify them as representing exponential growth or decay.*

[MAFS.912.F-BF.1.1:](#)

Write a function that describes a relationship between two quantities. ★

- a. Determine an explicit expression, a recursive process, or steps for calculation from a context.
- b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*
- c. Compose functions. *For example, if  $T(y)$  is the temperature in the atmosphere as a function of height, and  $h(t)$  is the height of a weather balloon as a function of time, then  $T(h(t))$  is the temperature at the location of the weather balloon as a function of time.*

[MAFS.912.F-BF.1.2:](#)

Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. ★

[MAFS.912.F-BF.2.5:](#)

Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving

logarithms and exponents.

[MAFS.912.F-LE.1.4:](#)

For exponential models, express as a logarithm the solution to  $ab^c = d$  where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology. ★

Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. ★

[MAFS.912.S-ID.2.6:](#)

- a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear, and exponential models.*
- b. Informally assess the fit of a function by plotting and analyzing residuals.
- c. Fit a linear function for a scatter plot that suggests a linear association.

**Remarks/Examples:**

Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals.

[MAFS.912.S-IC.2.6:](#)

Evaluate reports based on data. ★

Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values. ★

[MAFS.912.S-MD.2.5:](#)

- a. Find the expected payoff for a game of chance. *For example, find the expected winnings from a state lottery ticket or a game at a fast-food restaurant.*
- b. Evaluate and compare strategies on the basis of expected values. *For example, compare a high-deductible versus a low-deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident.*

[LAFS.910.SL.1.1:](#)

Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

- a. Come to discussions prepared, having read and researched

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|                                    | <p>material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.</p> <ul style="list-style-type: none"> <li>b. Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed.</li> <li>c. Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.</li> <li>d. Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.</li> </ul> |
| <a href="#">LAFS.910.SL.1.2:</a>   | <p>Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.</p>   |
| <a href="#">LAFS.910.SL.1.3:</a>   | <p>Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.</p>  |
| <a href="#">LAFS.910.SL.2.4:</a>   | <p>Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.</p>  |
| <a href="#">LAFS.910.RST.1.3:</a>  | <p>Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.</p>  |
| <a href="#">LAFS.910.RST.2.4:</a>  | <p>Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.</p>  |
| <a href="#">LAFS.910.RST.3.7:</a>  | <p>Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.</p>   |
| <a href="#">LAFS.910.WHST.1.1:</a> | <p>Write arguments focused on <i>discipline-specific content</i>.</p> <ul style="list-style-type: none"> <li>a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.</li> </ul>  |

- b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience’s knowledge level and concerns.
- c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.
- d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
- e. Provide a concluding statement or section that follows from or supports the argument presented.

[LAFS.910.WHST.2.4:](#) Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

[LAFS.910.WHST.3.9:](#) Draw evidence from informational texts to support analysis, reflection, and research.

**Make sense of problems and persevere in solving them.**

[MAFS.K12.MP.1.1:](#) Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

### **Reason abstractly and quantitatively.**

[MAFS.K12.MP.2.1:](#)

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

### **Construct viable arguments and critique the reasoning of others.**

[MAFS.K12.MP.3.1:](#)

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

### **Model with mathematics.**

[MAFS.K12.MP.4.1:](#)

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a

student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another.

Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

**Use appropriate tools strategically.**

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

[MAFS.K12.MP.5.1:](#)

**Attend to precision.**

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently,

[MAFS.K12.MP.6.1:](#)

express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

**Look for and make use of structure.**

[MAFS.K12.MP.7.1:](#)

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

**Look for and express regularity in repeated reasoning.**

[MAFS.K12.MP.8.1:](#)

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.AC.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.





## M/J Intensive Mathematics (MC) (#1204000)

**Version for Academic Year:** 2015 - 2016

**Course Number:** 1204000

**Abbreviated Title:** M/J INTENS MATH (MC)

**Course Length:** Year (Y)

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 6,7,8

### GENERAL NOTES

For each year in which a student scores at Level 1 on FCAT 2.0 Mathematics, the student must receive remediation by completing an intensive mathematics course the following year or having the remediation integrated into the student's required mathematics course. This course should be tailored to meet the needs of the individual student. Appropriate benchmarks from the following set of standards should be identified to develop an appropriate curriculum.

#### English Language Development ELD Standards Special Notes Section:

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

### COURSE STANDARDS

| Name                           | Description   |
|--------------------------------|---|
| <a href="#">MAFS.6.RP.1.1:</a> | Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. <i>For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes."</i> |
| <a href="#">MAFS.6.RP.1.2:</a> | Understand the concept of a unit rate $a/b$ associated with a ratio $a:b$   |

with  $b \neq 0$ , and use rate language in the context of a ratio relationship. *For example, "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is  $\frac{3}{4}$  cup of flour for each cup of sugar." "We paid \$75 for 15 hamburgers, which is a rate of \$5 per hamburger."*

Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.

[MAFS.6.RP.1.3:](#)

- a. Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.
- b. Solve unit rate problems including those involving unit pricing and constant speed. *For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?*
- c. Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means  $\frac{30}{100}$  times the quantity); solve problems involving finding the whole, given a part and the percent.
- d. Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.
- e. Understand the concept of  $\pi$  as the ratio of the circumference of a circle to its diameter.

(<sup>1</sup>See [Table 2 Common Multiplication and Division Situations](#))

**Remarks/Examples:**

**Examples of Opportunities for In-Depth Focus**

When students work toward meeting this standard, they use a range of reasoning and representations to analyze proportional relationships.

[MAFS.6.NS.1.1:](#)

Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. *For example, create a story context for  $(\frac{2}{3}) \div (\frac{3}{4})$  and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that  $(\frac{2}{3}) \div (\frac{3}{4}) = \frac{8}{9}$  because  $\frac{3}{4}$  of  $\frac{8}{9}$  is  $\frac{2}{3}$ . (In general,  $(\frac{a}{b}) \div (\frac{c}{d}) = \frac{ad}{bc}$ .) How much chocolate will each person get if 3 people share  $\frac{1}{2}$  lb of chocolate equally? How many  $\frac{3}{4}$ -cup servings are in  $\frac{2}{3}$  of a cup of yogurt? How wide is a rectangular strip of land with length  $\frac{3}{4}$*

*mi and area  $1/2$  square mi?*

**Remarks/Examples:  
Examples of Opportunities for In-Depth Focus**

This is a culminating standard for extending multiplication and division to fractions.

**Fluency Expectations or Examples of Culminating Standards**

Students interpret and compute quotients of fractions and solve word problems involving division of fractions by fractions. This completes the extension of operations to fractions.

Fluently divide multi-digit numbers using the standard algorithm.

[MAFS.6.NS.2.2:](#)

**Remarks/Examples:  
Fluency Expectations or Examples of Culminating Standards**

Students fluently divide multi-digit numbers using the standard algorithm. This is the culminating standard for several years' worth of work with division of whole numbers.

Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.

[MAFS.6.NS.2.3:](#)

**Remarks/Examples:  
Fluency Expectations or Examples of Culminating Standards**

Students fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation. This is the culminating standard for several years' worth of work relating to the domains of Number and Operations in Base Ten, Operations and Algebraic Thinking, and Number and Operations — Fractions.

[MAFS.6.NS.2.4:](#)

Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers 1–100 with a common factor as a

multiple of a sum of two whole numbers with no common factor.  
*For example, express  $36 + 8$  as  $4(9 + 2)$ .*

[MAFS.6.NS.3.5:](#)

Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.

Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates.

[MAFS.6.NS.3.6:](#)

- a. Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself, e.g.,  $-(-3) = 3$ , and that 0 is its own opposite.
- b. Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes.
- c. Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.

[MAFS.6.NS.3.7:](#)

Understand ordering and absolute value of rational numbers.

- a. Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram.  
*For example, interpret  $-3 > -7$  as a statement that  $-3$  is located to the right of  $-7$  on a number line oriented from left to right.*
- b. Write, interpret, and explain statements of order for rational numbers in real-world contexts. *For example, write  $-3^{\circ}\text{C} > -7^{\circ}\text{C}$  to express the fact that  $-3^{\circ}\text{C}$  is warmer than  $-7^{\circ}\text{C}$ .*
- c. Understand the absolute value of a rational number as its

distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation. *For example, for an account balance of -30 dollars, write  $|-30| = 30$  to describe the size of the debt in dollars.*

- d. Distinguish comparisons of absolute value from statements about order. *For example, recognize that an account balance less than -30 dollars represents a debt greater than 30 dollars.*

Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.

[MAFS.6.NS.3.8:](#)

**Remarks/Examples:  
Examples of Opportunities for In-Depth Focus**

When students work with rational numbers in the coordinate plane to solve problems, they combine and consolidate elements from the other standards in this cluster.

[MAFS.6.EE.1.1:](#)

Write and evaluate numerical expressions involving whole-number exponents.

Write, read, and evaluate expressions in which letters stand for numbers.

[MAFS.6.EE.1.2:](#)

- a. Write expressions that record operations with numbers and with letters standing for numbers. *For example, express the calculation “Subtract  $y$  from 5” as  $5 - y$ .*
- b. Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity. *For example, describe the expression  $2(8 + 7)$  as a product of two factors; view  $(8 + 7)$  as both a single entity and a sum of two terms.*
- c. Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). *For example, use*

*the formulas  $V = s^3$  and  $A = 6s^2$  to find the volume and surface area of a cube with sides of length  $s = 1/2$ .*

[MAFS.6.EE.1.3:](#)

Apply the properties of operations to generate equivalent expressions. *For example, apply the distributive property to the expression  $3(2 + x)$  to produce the equivalent expression  $6 + 3x$ ; apply the distributive property to the expression  $24x + 18y$  to produce the equivalent expression  $6(4x + 3y)$ ; apply properties of operations to  $y + y + y$  to produce the equivalent expression  $3y$ .*

**Remarks/Examples:**

**Examples of Opportunities for In-Depth Focus**

By applying properties of operations to generate equivalent expressions, students use properties of operations that they are familiar with from previous grades' work with numbers — generalizing arithmetic in the process.

[MAFS.6.EE.1.4:](#)

Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them). *For example, the expressions  $y + y + y$  and  $3y$  are equivalent because they name the same number regardless of which number  $y$  stands for.*

[MAFS.6.EE.2.5:](#)

Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.

[MAFS.6.EE.2.6:](#)

Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.

[MAFS.6.EE.2.7:](#)

Solve real-world and mathematical problems by writing and solving equations of the form  $x + p = q$  and  $px = q$  for cases in which  $p$ ,  $q$  and  $x$  are all non-negative rational numbers.

**Remarks/Examples:**

**Examples of Opportunities for In-Depth Focus**

When students write equations of the form  $x + p = q$  and  $px = q$  to solve real-world and mathematical problems, they draw on meanings of operations that they are familiar with from previous grades' work. They also begin to learn algebraic approaches to solving problems.<sup>16</sup>

<sup>16</sup> For example, suppose Daniel went to visit his grandmother, who gave him \$5.50. Then he bought a book costing \$9.20 and had \$2.30 left. To find how much money he had before visiting his grandmother, an algebraic approach leads to the equation  $x + 5.50 - 9.20 = 2.30$ . An arithmetic approach without using variables at all would be to begin with 2.30, then add 9.20, then subtract 5.50. This yields the desired answer, but students will eventually encounter problems in which arithmetic approaches are unrealistically difficult and algebraic approaches must be used.

[MAFS.6.EE.2.8:](#)

Write an inequality of the form  $x > c$  or  $x < c$  to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form  $x > c$  or  $x < c$  have infinitely many solutions; represent solutions of such inequalities on number line diagrams.

[MAFS.6.EE.3.9:](#)

Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. *For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation  $d = 65t$  to represent the relationship between distance and time.*

[MAFS.6.G.1.1:](#)

Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.

[MAFS.6.G.1.2:](#)

Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas  $V = lwh$  and  $V = Bh$  to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.

[MAFS.6.G.1.3:](#)

Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems.

[MAFS.6.G.1.4:](#)

Represent three-dimensional figures using nets made up of



|                                |   |
|--------------------------------|---|
|                                | rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.  |
| <a href="#">MAFS.6.SP.1.1:</a> | Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. <i>For example, “How old am I?” is not a statistical question, but “How old are the students in my school?” is a statistical question because one anticipates variability in students’ ages.</i>   |
| <a href="#">MAFS.6.SP.1.2:</a> | Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.  |
| <a href="#">MAFS.6.SP.1.3:</a> | Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.   |
| <a href="#">MAFS.6.SP.2.4:</a> | Display numerical data in plots on a number line, including dot plots, histograms, and box plots.   |
| <a href="#">MAFS.6.SP.2.5:</a> | Summarize numerical data sets in relation to their context, such as by: <ul style="list-style-type: none"> <li>a. Reporting the number of observations.</li> <li>b. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.</li> <li>c. Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.</li> <li>d. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.</li> </ul> |
| <a href="#">MAFS.7.RP.1.1:</a> | Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. <i>For example, if a person walks 1/2 mile in each 1/4 hour, compute the unit rate as the complex fraction 1/2/1/4 miles per hour, equivalently 2 miles per hour.</i>  |
| <a href="#">MAFS.7.RP.1.2:</a> | Recognize and represent proportional relationships between quantities. <ul style="list-style-type: none"> <li>a. Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.</li> </ul>  |

- b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.
- c. Represent proportional relationships by equations. *For example, if total cost  $t$  is proportional to the number  $n$  of items purchased at a constant price  $p$ , the relationship between the total cost and the number of items can be expressed as  $t = pn$ .*
- d. Explain what a point  $(x, y)$  on the graph of a proportional relationship means in terms of the situation, with special attention to the points  $(0, 0)$  and  $(1, r)$  where  $r$  is the unit rate.

**Remarks/Examples:  
Examples of Opportunities for In-Depth Focus**

Students in grade 7 grow in their ability to recognize, represent, and analyze proportional relationships in various ways, including by using tables, graphs, and equations.

[MAFS.7.RP.1.3:](#)

Use proportional relationships to solve multistep ratio and percent problems. *Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.*

Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.

[MAFS.7.NS.1.1:](#)

- a. Describe situations in which opposite quantities combine to make 0. *For example, a hydrogen atom has 0 charge because its two constituents are oppositely charged.*
- b. Understand  $p + q$  as the number located a distance  $|q|$  from  $p$ , in the positive or negative direction depending on whether  $q$  is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts.
- c. Understand subtraction of rational numbers as adding the additive inverse,  $p - q = p + (-q)$ . Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.
- d. Apply properties of operations as strategies to add and

subtract rational numbers.

**Remarks/Examples:  
Fluency Expectations or Examples of Culminating  
Standards**

Adding, subtracting, multiplying, and dividing rational numbers is the culmination of numerical work with the four basic operations. The number system will continue to develop in grade 8, expanding to become the real numbers by the introduction of irrational numbers, and will develop further in high school, expanding to become the complex numbers with the introduction of imaginary numbers. Because there are no specific standards for rational number arithmetic in later grades and because so much other work in grade 7 depends on rational number arithmetic, fluency with rational number arithmetic should be the goal in grade 7.

Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.

- a. Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as  $(-1)(-1) = 1$  and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts.
- b. Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If  $p$  and  $q$  are integers, then  $-(p/q) = (-p)/q = p/(-q)$ . Interpret quotients of rational numbers by describing real-world contexts.
- c. Apply properties of operations as strategies to multiply and divide rational numbers.
- d. Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.

[MAFS.7.NS.1.2:](#)

**Remarks/Examples:  
Fluency Expectations or Examples of Culminating  
Standards**

Adding, subtracting, multiplying, and dividing rational numbers is the culmination of numerical work with the four basic operations. The number system will continue to develop in grade 8, expanding to become the real numbers by the introduction of irrational numbers, and will develop further in high school, expanding to become the complex numbers with the introduction of imaginary numbers. Because there are no specific standards for rational number arithmetic in later grades and because so much other work in grade 7 depends on rational number arithmetic, fluency with rational number arithmetic should be the goal in grade 7.

Solve real-world and mathematical problems involving the four operations with rational numbers.

[MAFS.7.NS.1.3:](#)

**Remarks/Examples:  
Examples of Opportunities for In-Depth Focus**

When students work toward meeting this standard (which is closely connected to 7.NS.1.1 and 7.NS.1.2), they consolidate their skill and understanding of addition, subtraction, multiplication and division of rational numbers.

[MAFS.7.EE.1.1:](#)

Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.

[MAFS.7.EE.1.2:](#)

Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. *For example,  $a + 0.05a = 1.05a$  means that “increase by 5%” is the same as “multiply by 1.05.”*

[MAFS.7.EE.2.3:](#)

Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. *For example: If a woman making \$25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or \$2.50, for a new salary of \$27.50. If you want to place a towel bar  $9\frac{3}{4}$  inches long in the center of a door that is  $27\frac{1}{2}$  inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.*

**Remarks/Examples:**

### **Fluency Expectations or Examples of Culminating Standards**

Students solve multistep problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. This work is the culmination of many progressions of learning in arithmetic, problem solving and mathematical practices.

### **Examples of Opportunities for In-Depth Focus**

This is a major capstone standard for arithmetic and its applications.

Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.

- a. Solve word problems leading to equations of the form  $px + q = r$  and  $p(x + q) = r$ , where  $p$ ,  $q$ , and  $r$  are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. *For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?*
- b. Solve word problems leading to inequalities of the form  $px + q > r$  or  $px + q < r$ , where  $p$ ,  $q$ , and  $r$  are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. *For example: As a salesperson, you are paid \$50 per week plus \$3 per sale. This week you want your pay to be at least \$100. Write an inequality for the number of sales you need to make, and describe the solutions.*

[MAFS.7.EE.2.4:](#)

### **Remarks/Examples:**

### **Fluency Expectations or Examples of Culminating Standards**

In solving word problems leading to one-variable equations of the form  $px + q = r$  and  $p(x + q) = r$ , students solve the equations fluently. This will require fluency with rational number arithmetic (7.NS.1.1–1.3), as well as fluency to some extent with applying properties operations to rewrite linear

|                                |  |
|--------------------------------|--|
|                                | <p>expressions with rational coefficients (7.EE.1.1).</p> <p><b>Examples of Opportunities for In-Depth Focus</b></p> <p>Work toward meeting this standard builds on the work that led to meeting 6.EE.2.7 and prepares students for the work that will lead to meeting 8.EE.3.7.</p>   |
| <a href="#">MAFS.7.G.1.1:</a>  | Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.  |
| <a href="#">MAFS.7.G.1.2:</a>  | Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.  |
| <a href="#">MAFS.7.G.1.3:</a>  | Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.  |
| <a href="#">MAFS.7.G.2.4:</a>  | Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.   |
| <a href="#">MAFS.7.G.2.5:</a>  | Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure.  |
| <a href="#">MAFS.7.G.2.6:</a>  | <p>Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.</p> <div style="border: 1px solid black; padding: 10px;"> <p><b>Remarks/Examples:</b></p> <p><b>Examples of Opportunities for In-Depth Focus</b></p> <p>Work toward meeting this standard draws together grades 3–6 work with geometric measurement.</p> </div> |
| <a href="#">MAFS.7.SP.1.1:</a> | Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.   |
| <a href="#">MAFS.7.SP.1.2:</a> | Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate   |

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|                                       | <p>multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions. <i>For example, estimate the mean word length in a book by randomly sampling words from the book; predict the winner of a school election based on randomly sampled survey data. Gauge how far off the estimate or prediction might be.</i></p>   |
| <p><a href="#">MAFS.7.SP.2.3:</a></p> | <p>Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability. <i>For example, the mean height of players on the basketball team is 10 cm greater than the mean height of players on the soccer team, about twice the variability (mean absolute deviation) on either team; on a dot plot, the separation between the two distributions of heights is noticeable.</i></p>   |
| <p><a href="#">MAFS.7.SP.2.4:</a></p> | <p>Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations. <i>For example, decide whether the words in a chapter of a seventh-grade science book are generally longer than the words in a chapter of a fourth-grade science book.</i></p>  |
| <p><a href="#">MAFS.7.SP.3.5:</a></p> | <p>Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around <math>\frac{1}{2}</math> indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.</p>   |
| <p><a href="#">MAFS.7.SP.3.6:</a></p> | <p>Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability. <i>For example, when rolling a number cube 600 times, predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times.</i></p>  |
| <p><a href="#">MAFS.7.SP.3.7:</a></p> | <p>Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy.</p> <ol style="list-style-type: none"> <li>a. Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. <i>For example, if a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.</i></li> <li>b. Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. <i>For example, find the approximate probability that a spinning penny will land heads up or that a tossed paper</i></li> </ol> |

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|                                       | <p><i>cup will land open-end down. Do the outcomes for the spinning penny appear to be equally likely based on the observed frequencies?</i></p>   |
| <p><a href="#">MAFS.7.SP.3.8:</a></p> | <p>Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.</p> <ol style="list-style-type: none"> <li>Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.</li> <li>Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., “rolling double sixes”), identify the outcomes in the sample space which compose the event.</li> <li>Design and use a simulation to generate frequencies for compound events. <i>For example, use random digits as a simulation tool to approximate the answer to the question: If 40% of donors have type A blood, what is the probability that it will take at least 4 donors to find one with type A blood?</i></li> </ol> |
| <p><a href="#">MAFS.8.NS.1.1:</a></p> | <p>Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.</p>   |
| <p><a href="#">MAFS.8.NS.1.2:</a></p> | <p>Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., <math>\pi^2</math>). <i>For example, by truncating the decimal expansion of <math>\sqrt{2}</math>, show that <math>\sqrt{2}</math> is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.</i></p>   |
| <p><a href="#">MAFS.8.EE.1.1:</a></p> | <p>Know and apply the properties of integer exponents to generate equivalent numerical expressions. <i>For example, <math>3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27</math></i></p>   |
| <p><a href="#">MAFS.8.EE.1.2:</a></p> | <p>Use square root and cube root symbols to represent solutions to equations of the form <math>x^2 = p</math> and <math>x^3 = p</math>, where <math>p</math> is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that <math>\sqrt{2}</math> is irrational.</p>   |
| <p><a href="#">MAFS.8.EE.1.3:</a></p> | <p>Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. <i>For</i></p>   |



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|                                       | <p>example, estimate the population of the United States as <math>3 \times 10^8</math> and the population of the world as <math>7 \times 10^9</math>, and determine that the world population is more than 20 times larger.</p>   |
| <p><a href="#">MAFS.8.EE.1.4:</a></p> | <p>Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.</p>   |
| <p><a href="#">MAFS.8.EE.2.5:</a></p> | <p>Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. <i>For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.</i></p> <div style="border: 1px solid black; padding: 10px;"> <p><b>Remarks/Examples:</b><br/> <b>Examples of Opportunities for In-Depth Focus</b></p> <p>When students work toward meeting this standard, they build on grades 6–7 work with proportions and position themselves for grade 8 work with functions and the equation of a line.</p> </div>   |
| <p><a href="#">MAFS.8.EE.2.6:</a></p> | <p>Use similar triangles to explain why the slope <math>m</math> is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation <math>y = mx</math> for a line through the origin and the equation <math>y = mx + b</math> for a line intercepting the vertical axis at <math>b</math>.</p>  |
| <p><a href="#">MAFS.8.EE.3.7:</a></p> | <p>Solve linear equations in one variable.</p> <ol style="list-style-type: none"> <li>a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form <math>x = a</math>, <math>a = a</math>, or <math>a = b</math> results (where <math>a</math> and <math>b</math> are different numbers).</li> <li>b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.</li> </ol> <div style="border: 1px solid black; padding: 10px;"> <p><b>Remarks/Examples:</b><br/> <b>Fluency Expectations or Examples of Culminating</b></p> </div> |

### Standards

Students have been working informally with one-variable linear equations since as early as kindergarten. This important line of development culminates in grade 8 with the solution of general one-variable linear equations, including cases with infinitely many solutions or no solutions as well as cases requiring algebraic manipulation using properties of operations. Coefficients and constants in these equations may be any rational numbers.

### Examples of Opportunities for In-Depth Focus

This is a culminating standard for solving one-variable linear equations.

Analyze and solve pairs of simultaneous linear equations.

- a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.
- b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. *For example,  $3x + 2y = 5$  and  $3x + 2y = 6$  have no solution because  $3x + 2y$  cannot simultaneously be 5 and 6.*
- c. Solve real-world and mathematical problems leading to two linear equations in two variables. *For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.*

[MAFS.8.EE.3.8:](#)

### Remarks/Examples:

### Examples of Opportunities for In-Depth Focus

When students work toward meeting this standard, they build on what they know about two-variable linear equations, and they enlarge the varieties of real-world and mathematical problems they can solve.

[MAFS.8.F.1.1:](#)

Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.

Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.*

[MAFS.8.F.1.2:](#)

**Remarks/Examples:**

**Examples of Opportunities for In-Depth Focus**

Work toward meeting this standard repositions previous work with tables and graphs in the new context of input/output rules.

[MAFS.8.F.1.3:](#)

Interpret the equation  $y = mx + b$  as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. *For example, the function  $A = s^2$  giving the area of a square as a function of its side length is not linear because its graph contains the points  $(1,1)$ ,  $(2,4)$  and  $(3,9)$ , which are not on a straight line.*

[MAFS.8.F.2.4:](#)

Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two  $(x, y)$  values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.

[MAFS.8.F.2.5:](#)

Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

Verify experimentally the properties of rotations, reflections, and translations:

[MAFS.8.G.1.1:](#)

- a. Lines are taken to lines, and line segments to line segments of the same length.
- b. Angles are taken to angles of the same measure.
- c. Parallel lines are taken to parallel lines.

[MAFS.8.G.1.2:](#)

Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.

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| <a href="#">MAFS.8.G.1.3:</a> | Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.   |
| <a href="#">MAFS.8.G.1.4:</a> | Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.  |
| <a href="#">MAFS.8.G.1.5:</a> | Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. <i>For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.</i>   |
| <a href="#">MAFS.8.G.2.6:</a> | Explain a proof of the Pythagorean Theorem and its converse.   |
| <a href="#">MAFS.8.G.2.7:</a> | <p>Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.</p> <div style="border: 1px solid black; padding: 10px;"> <p><b>Remarks/Examples:<br/>Examples of Opportunities for In-Depth Focus</b></p> <p>The Pythagorean theorem is useful in practical problems, relates to grade-level work in irrational numbers and plays an important role mathematically in coordinate geometry in high school.</p> </div>   |
| <a href="#">MAFS.8.G.2.8:</a> | Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.  |
| <a href="#">MAFS.8.G.3.9:</a> | <p>Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.</p> <div style="border: 1px solid black; padding: 10px;"> <p><b>Remarks/Examples:<br/>Fluency Expectations or Examples of Culminating Standards</b></p> <p>When students learn to solve problems involving volumes of cones, cylinders, and spheres — together with their previous grade 7 work in angle measure, area, surface area and volume (7.G.2.4–2.6) — they will have acquired a well-developed set of geometric measurement skills. These skills, along with proportional reasoning (7.RP) and multistep numerical problem solving (7.EE.2.3), can be combined and used in flexible ways as part of modeling during high school — not to</p> </div> |

mention after high school for college and careers.

[MAFS.8.SP.1.1:](#)

Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.

[MAFS.8.SP.1.2:](#)

Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.

[MAFS.8.SP.1.3:](#)

Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. *For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.*

[MAFS.8.SP.1.4:](#)

Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. *For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?*

[LAFS.6.SL.1.1:](#)

Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly.

- a. Come to discussions prepared, having read or studied required material; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.
- b. Follow rules for collegial discussions, set specific goals and deadlines, and define individual roles as needed.
- c. Pose and respond to specific questions with elaboration and detail by making comments that contribute to the topic, text, or issue under discussion.
- d. Review the key ideas expressed and demonstrate understanding of multiple perspectives through reflection and paraphrasing.

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| <a href="#">LAFS.6.SL.1.2:</a> | Interpret information presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how it contributes to a topic, text, or issue under study.  |
| <a href="#">LAFS.6.SL.1.3:</a> | Delineate a speaker’s argument and specific claims, distinguishing claims that are supported by reasons and evidence from claims that are not.  |
| <a href="#">LAFS.6.SL.2.4:</a> | Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume, and clear pronunciation.   |
| <a href="#">LAFS.7.SL.1.1:</a> | Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 7 topics, texts, and issues, building on others’ ideas and expressing their own clearly. <ul style="list-style-type: none"> <li>a. Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.</li> <li>b. Follow rules for collegial discussions, track progress toward specific goals and deadlines, and define individual roles as needed.</li> <li>c. Pose questions that elicit elaboration and respond to others’ questions and comments with relevant observations and ideas that bring the discussion back on topic as needed.</li> <li>d. Acknowledge new information expressed by others and, when warranted, modify their own views.</li> </ul> |
| <a href="#">LAFS.7.SL.1.2:</a> | Analyze the main ideas and supporting details presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how the ideas clarify a topic, text, or issue under study.  |
| <a href="#">LAFS.7.SL.1.3:</a> | Delineate a speaker’s argument and specific claims, evaluating the soundness of the reasoning and the relevance and sufficiency of the evidence.  |
| <a href="#">LAFS.7.SL.2.4:</a> | Present claims and findings, emphasizing salient points in a focused, coherent manner with pertinent descriptions, facts, details, and examples; use appropriate eye contact, adequate volume, and clear pronunciation.   |
| <a href="#">LAFS.8.SL.1.1:</a> | Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others’ ideas and expressing their own clearly. <ul style="list-style-type: none"> <li>a. Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by</li> </ul>   |

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|                                   | <p>referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.</p> <ul style="list-style-type: none"> <li>b. Follow rules for collegial discussions and decision-making, track progress toward specific goals and deadlines, and define individual roles as needed.</li> <li>c. Pose questions that connect the ideas of several speakers and respond to others' questions and comments with relevant evidence, observations, and ideas.</li> <li>d. Acknowledge new information expressed by others, and, when warranted, qualify or justify their own views in light of the evidence presented.</li> </ul>  |
| <a href="#">LAFS.8.SL.1.2:</a>    | Analyze the purpose of information presented in diverse media and formats (e.g., visually, quantitatively, orally) and evaluate the motives (e.g., social, commercial, political) behind its presentation.   |
| <a href="#">LAFS.8.SL.1.3:</a>    | Delineate a speaker's argument and specific claims, evaluating the soundness of the reasoning and relevance and sufficiency of the evidence and identifying when irrelevant evidence is introduced.  |
| <a href="#">LAFS.8.SL.2.4:</a>    | Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.   |
| <a href="#">LAFS.68.RST.1.3:</a>  | Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.  |
| <a href="#">LAFS.68.RST.2.4:</a>  | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.   |
| <a href="#">LAFS.68.RST.3.7:</a>  | Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).  |
| <a href="#">LAFS.68.WHST.1.1:</a> | <p>Write arguments focused on <i>discipline-specific content</i>.</p> <ul style="list-style-type: none"> <li>a. Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.</li> <li>b. Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.</li> <li>c. Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.</li> <li>d. Establish and maintain a formal style.</li> <li>e. Provide a concluding statement or section that follows from and supports the argument presented.</li> </ul> |

**Make sense of problems and persevere in solving them.**

[MAFS.K12.MP.1.1:](#)

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

**Reason abstractly and quantitatively.**

[MAFS.K12.MP.2.1:](#)

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

**Construct viable arguments and critique the reasoning of others.**

[MAFS.K12.MP.3.1:](#)

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical



progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

**Model with mathematics.**

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another.

[MAFS.K12.MP.4.1:](#)

Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

**Use appropriate tools strategically.**

[MAFS.K12.MP.5.1:](#)

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are

sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

**Attend to precision.**

[MAFS.K12.MP.6.1:](#)

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

**Look for and make use of structure.**

[MAFS.K12.MP.7.1:](#)

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value

cannot be more than 5 for any real numbers  $x$  and  $y$ .

**Look for and express regularity in repeated reasoning.**

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through  $(1, 2)$  with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

[MAFS.K12.MP.8.1:](#)

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.AC.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.

## Mathematics Transfer (#1200990)

**Version for Academic Year:** 2015 - 2016

**Course Number:** 1200990

**Abbreviated Title:** MATH TRAN

**Course Status:** Draft - Course Pending Approval

### GENERAL NOTES

#### English Language Development ELD Standards Special Notes Section:

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

### COURSE STANDARDS

| Name                              | Description  |
|-----------------------------------|--|
| <a href="#">ELD.K12.ELL.1.1:</a>  | English language learners communicate for social and instructional purposes within the school setting.                                   |
| <a href="#">ELD.K12.ELL.AC.1:</a> | English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics. |

## Mathematics for College Success (#1200410)

**Version for Academic Year:** 2015 - 2016

**Course Number:** 1200410

**Abbreviated Title:** MATH COLL SUCCESS

**Number of Credits:** Half credit (.5)

**Course Length:** Semester (S)

**Course Type:** Core

**Course Level:** 2

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 9,10,11,12

### GENERAL NOTES

This course is targeted for grade 12 students, whose test scores on the Postsecondary Educational Readiness Test (P.E.R.T.) are below the established cut scores for mathematics, indicating that they are not yet “college ready” in mathematics. This course incorporates the Florida Standards for Mathematical Practices as well as the following Florida Standards for Mathematical Content: Expressions and Equations, The Number System, Ratios and Proportional Relationships, Functions, Algebra, Geometry, Number and Quantity, Statistics and Probability, and the Florida Standards for High School Modeling. The standards align with the Mathematics Postsecondary Readiness Competencies deemed necessary for entry-level college courses.

#### **English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL’s need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

### COURSE STANDARDS

| Name                           | Description  |
|--------------------------------|--|
| <a href="#">MAFS.6.EE.1.2:</a> | Write, read, and evaluate expressions in which letters stand for |

numbers.

- a. Write expressions that record operations with numbers and with letters standing for numbers. *For example, express the calculation “Subtract  $y$  from 5” as  $5 - y$ .*
- b. Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity. *For example, describe the expression  $2(8 + 7)$  as a product of two factors; view  $(8 + 7)$  as both a single entity and a sum of two terms.*
- c. Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). *For example, use the formulas  $V = s^3$  and  $A = 6s^2$  to find the volume and surface area of a cube with sides of length  $s = 1/2$ .*

[MAFS.7.RP.1.3:](#)

Use proportional relationships to solve multistep ratio and percent problems. *Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.*

[MAFS.7.NS.1.1:](#)

Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.

- a. Describe situations in which opposite quantities combine to make 0. *For example, a hydrogen atom has 0 charge because its two constituents are oppositely charged.*
- b. Understand  $p + q$  as the number located a distance  $|q|$  from  $p$ , in the positive or negative direction depending on whether  $q$  is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts.
- c. Understand subtraction of rational numbers as adding the additive inverse,  $p - q = p + (-q)$ . Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.
- d. Apply properties of operations as strategies to add and

subtract rational numbers.

**Remarks/Examples:  
Fluency Expectations or Examples of Culminating  
Standards**

Adding, subtracting, multiplying, and dividing rational numbers is the culmination of numerical work with the four basic operations. The number system will continue to develop in grade 8, expanding to become the real numbers by the introduction of irrational numbers, and will develop further in high school, expanding to become the complex numbers with the introduction of imaginary numbers. Because there are no specific standards for rational number arithmetic in later grades and because so much other work in grade 7 depends on rational number arithmetic, fluency with rational number arithmetic should be the goal in grade 7.

Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.

- a. Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as  $(-1)(-1) = 1$  and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts.
- b. Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If  $p$  and  $q$  are integers, then  $-(p/q) = (-p)/q = p/(-q)$ . Interpret quotients of rational numbers by describing real-world contexts.
- c. Apply properties of operations as strategies to multiply and divide rational numbers.
- d. Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.

[MAFS.7.NS.1.2:](#)

**Remarks/Examples:  
Fluency Expectations or Examples of Culminating  
Standards**

Adding, subtracting, multiplying, and dividing rational numbers is the culmination of numerical work with the four basic operations. The number system will continue to develop in grade 8, expanding to become the real numbers by the introduction of irrational numbers, and will develop further in high school, expanding to become the complex numbers with the introduction of imaginary numbers. Because there are no specific standards for rational number arithmetic in later grades and because so much other work in grade 7 depends on rational number arithmetic, fluency with rational number arithmetic should be the goal in grade 7.

Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. *For example: If a woman making \$25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or \$2.50, for a new salary of \$27.50. If you want to place a towel bar  $9\frac{3}{4}$  inches long in the center of a door that is  $27\frac{1}{2}$  inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.*

[MAFS.7.EE.2.3:](#)

**Remarks/Examples:  
Fluency Expectations or Examples of Culminating Standards**

Students solve multistep problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. This work is the culmination of many progressions of learning in arithmetic, problem solving and mathematical practices.

**Examples of Opportunities for In-Depth Focus**

This is a major capstone standard for arithmetic and its applications.

[MAFS.7.EE.2.4:](#)

Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.



- a. Solve word problems leading to equations of the form  $px + q = r$  and  $p(x + q) = r$ , where  $p$ ,  $q$ , and  $r$  are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. *For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?*
- b. Solve word problems leading to inequalities of the form  $px + q > r$  or  $px + q < r$ , where  $p$ ,  $q$ , and  $r$  are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. *For example: As a salesperson, you are paid \$50 per week plus \$3 per sale. This week you want your pay to be at least \$100. Write an inequality for the number of sales you need to make, and describe the solutions.*

**Remarks/Examples:**

**Fluency Expectations or Examples of Culminating Standards**

In solving word problems leading to one-variable equations of the form  $px + q = r$  and  $p(x + q) = r$ , students solve the equations fluently. This will require fluency with rational number arithmetic (7.NS.1.1–1.3), as well as fluency to some extent with applying properties operations to rewrite linear expressions with rational coefficients (7.EE.1.1).

**Examples of Opportunities for In-Depth Focus**

Work toward meeting this standard builds on the work that led to meeting 6.EE.2.7 and prepares students for the work that will lead to meeting 8.EE.3.7.

[MAFS.8.NS.1.1:](#)

Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.

[MAFS.8.NS.1.2:](#)

Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g.,  $\pi^2$ ). *For example, by truncating the decimal expansion of  $\sqrt{2}$ , show that  $\sqrt{2}$  is between 1 and 2, then between 1.4 and 1.5, and explain how to*

|                                    |   |
|------------------------------------|---|
|                                    | <i>continue on to get better approximations.</i>  |
| <a href="#">MAFS.8.EE.1.1:</a>     | Know and apply the properties of integer exponents to generate equivalent numerical expressions. <i>For example, <math>3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27</math></i>   |
| <a href="#">MAFS.8.EE.1.4:</a>     | Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.                              |
| <a href="#">MAFS.8.EE.2.5:</a>     | Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. <i>For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.</i>   |
|                                    | <div style="border: 1px solid black; padding: 10px;"> <p><b>Remarks/Examples:</b><br/> <b>Examples of Opportunities for In-Depth Focus</b></p> <p>When students work toward meeting this standard, they build on grades 6–7 work with proportions and position themselves for grade 8 work with functions and the equation of a line.</p> </div>  |
| <a href="#">MAFS.8.F.2.4:</a>      | Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values. |
| <a href="#">MAFS.912.N-RN.1.2:</a> | Rewrite expressions involving radicals and rational exponents using the properties of exponents.  |
| <a href="#">MAFS.912.N-Q.1.1:</a>  | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. ★   |
| <a href="#">MAFS.912.N-Q.1.2:</a>  | Define appropriate quantities for the purpose of descriptive modeling. ★  |
|                                    | <div style="border: 1px solid black; padding: 10px;"> <p><b>Remarks/Examples:</b><br/> <b>Algebra 1 Content Notes:</b></p> </div>   |

Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions.

[MAFS.912.N-Q.1.3:](#)

Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. ★

[MAFS.912.A-SSE.1.1:](#)

Interpret expressions that represent a quantity in terms of its context. ★

- a. Interpret parts of an expression, such as terms, factors, and coefficients.
- b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret as the product of  $P$  and a factor not depending on  $P$ .*

$P(1+r)^n$

[MAFS.912.A-SSE.1.2:](#)

Use the structure of an expression to identify ways to rewrite it. *For example, see  $x^4 - y^4$  as  $(x^2)^2 - (y^2)^2$ , thus recognizing it as a difference of squares that can be factored as  $(x^2 - y^2)(x^2 + y^2)$ .*

[MAFS.912.A-SSE.2.3:](#)

Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. ★

- a. Factor a quadratic expression to reveal the zeros of the function it defines.
- b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
- c. Use the properties of exponents to transform expressions for exponential functions. *For example the expression can be rewritten as  $(1.15)^{12t} \approx 1.012^{12t}$  to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*

1.15

$(1.15)^{12t} \approx 1.012^{12t}$

[MAFS.912.A-APR.1.1:](#)

Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.

**Remarks/Examples:  
Algebra 1 - Fluency Recommendations**

Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in algebra, as well as

|                                     |  |
|-------------------------------------|--|
|                                     | in their symbolic work with functions. Manipulation can be more mindful when it is fluent.   |
| <a href="#">MAFS.912.A-APR.2.3:</a> | Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.  |
| <a href="#">MAFS.912.A-APR.3.4:</a> | Prove polynomial identities and use them to describe numerical relationships. For example, the polynomial identity $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ can be used to generate Pythagorean triples.  |
| <a href="#">MAFS.912.A-APR.4.7:</a> | Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.   |
| <a href="#">MAFS.912.A-CED.1.1:</a> | Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational, absolute, and exponential functions. ★   |
| <a href="#">MAFS.912.A-CED.1.2:</a> | Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. ★  |
| <a href="#">MAFS.912.A-CED.1.3:</a> | Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. <i>For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.</i> ★ |
| <a href="#">MAFS.912.A-CED.1.4:</a> | Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. <i>For example, rearrange Ohm's law <math>V = IR</math> to highlight resistance <math>R</math>.</i> ★  |
| <a href="#">MAFS.912.A-REL.1.1:</a> | Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.  |
| <a href="#">MAFS.912.A-REL.1.2:</a> | Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.   |
| <a href="#">MAFS.912.A-REL.2.3:</a> | Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.   |
| <a href="#">MAFS.912.A-REL.2.4:</a> | Solve quadratic equations in one variable. <ul style="list-style-type: none"> <li>a. Use the method of completing the square to transform any quadratic equation in <math>x</math> into an equation of the form <math>(x - p)^2 = q</math> that has the same solutions. Derive the quadratic</li> </ul>          |

formula from this form.

- b. Solve quadratic equations by inspection (e.g., for  $x^2 = 49$ ), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as  $a \pm bi$  for real numbers  $a$  and  $b$ .

[MAFS.912.A-REL.3.5:](#)

Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.

[MAFS.912.A-REL.3.6:](#)

Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

[MAFS.912.A-REL.4.10:](#)

Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

[MAFS.912.A-REL.4.11:](#)

Explain why the  $x$ -coordinates of the points where the graphs of the equations  $y = f(x)$  and  $y = g(x)$  intersect are the solutions of the equation  $f(x) = g(x)$ ; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where  $f(x)$  and/or  $g(x)$  are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. ★

[MAFS.912.F-IF.1.1:](#)

Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If  $f$  is a function and  $x$  is an element of its domain, then  $f(x)$  denotes the output of  $f$  corresponding to the input  $x$ . The graph of  $f$  is the graph of the equation  $y = f(x)$ .

[MAFS.912.F-IF.2.4:](#)

For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.* ★

[MAFS.912.F-IF.2.5:](#)

Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function  $h(n)$  gives the number of person-hours it takes to assemble engines in a factory, then the positive integers would be an appropriate domain for the function.* ★

[MAFS.912.F-IF.2.6:](#)

Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. ★

[MAFS.912.F-IF.3.7:](#)

Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★

- Graph linear and quadratic functions and show intercepts, maxima, and minima.
- Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
- Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.
- Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.
- Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.

[MAFS.912.F-IF.3.8:](#)

Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

- Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
- Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as  $y = (1.02)^t$ ,  $y = (0.97)^t$ ,  $y = (1.01)^{12t}$ ,  $y = (1.2)^{\sqrt{t}}$ , and classify them as representing exponential growth or decay.*

[MAFS.912.F-BF.1.1:](#)

Write a function that describes a relationship between two quantities. ★

- Determine an explicit expression, a recursive process, or steps for calculation from a context.
- Combine standard function types using arithmetic

|  |   |
|--|---|
|  | <p>operations. <i>For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.</i></p> <p>c. Compose functions. <i>For example, if <math>T(y)</math> is the temperature in the atmosphere as a function of height, and <math>h(t)</math> is the height of a weather balloon as a function of time, then <math>T(h(t))</math> is the temperature at the location of the weather balloon as a function of time.</i></p>  |
| <p><a href="#">MAFS.912.F-BF.2.3:</a></p>  | <p>Identify the effect on the graph of replacing <math>f(x)</math> by <math>f(x) + k</math>, <math>k f(x)</math>, <math>f(kx)</math>, and <math>f(x + k)</math> for specific values of <math>k</math> (both positive and negative); find the value of <math>k</math> given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. <i>Include recognizing even and odd functions from their graphs and algebraic expressions for them.</i></p>  |
| <p><a href="#">MAFS.912.G-GPE.2.5:</a></p> | <p>Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).</p> <div style="border: 1px solid black; padding: 10px; margin-top: 10px;"> <p><b>Remarks/Examples:<br/>Geometry - Fluency Recommendations</b></p> <p>Fluency with the use of coordinates to establish geometric results, calculate length and angle, and use geometric representations as a modeling tool are some of the most valuable tools in mathematics and related fields.</p> </div> |
| <p><a href="#">MAFS.912.S-ID.2.5:</a></p>  | <p>Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. ★</p>  |
| <p><a href="#">MAFS.912.S-ID.2.6:</a></p>  | <p>Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. ★</p> <p>a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. <i>Use given functions or choose a function suggested by the context. Emphasize linear, and exponential models.</i></p> <p>b. Informally assess the fit of a function by plotting and analyzing residuals.</p> <p>c. Fit a linear function for a scatter plot that suggests a linear</p>  |

association.

**Remarks/Examples:**

Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals.

[MAFS.912.S-ID.3.7:](#)

Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. ★

[MAFS.K12.MP.1.1:](#)

**Make sense of problems and persevere in solving them.**

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

[MAFS.K12.MP.2.1:](#)

**Reason abstractly and quantitatively.**

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to



contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

**Construct viable arguments and critique the reasoning of others.**

[MAFS.K12.MP.3.1:](#)

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

**Model with mathematics.**

[MAFS.K12.MP.4.1:](#)

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as

diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

**Use appropriate tools strategically.**

[MAFS.K12.MP.5.1:](#)

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

**Attend to precision.**

[MAFS.K12.MP.6.1:](#)

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

[MAFS.K12.MP.7.1:](#)

**Look for and make use of structure.**

Mathematically proficient students look closely to discern a pattern

or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

**Look for and express regularity in repeated reasoning.**

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

[MAFS.K12.MP.8.1:](#)

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.AC.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.

## Mathematics for College Readiness (#1200700)

**Version for Academic Year:** 2015 - 2016

**Course Number:** 1200700

**Abbreviated Title:** MATH COLL READINESS

**Number of Credits:** One credit (1)

**Course Length:** Year (Y)

**Course Type:** Core

**Course Level:** 2

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 9,10,11,12

### GENERAL NOTES

This course is targeted for grade 12 students, whose test scores on the Postsecondary Educational Readiness Test (P.E.R.T.) are at or below the established cut scores for mathematics, indicating that they are not yet “college ready” in mathematics or simply need some additional instruction in content to prepare them for success in college level mathematics. This course incorporates the Florida Standards for Mathematical Practices as well as the following Florida Standards for Mathematical Content: Expressions and Equations, The Number System, Functions, Algebra, Geometry, Number and Quantity, Statistics and Probability, and the Florida Standards for High School Modeling. The standards align with the Mathematics Postsecondary Readiness Competencies deemed necessary for entry-level college courses.

#### **English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL’s need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

### COURSE STANDARDS

| Name | Description |
|------|-------------|
|------|-------------|

Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.

- a. Describe situations in which opposite quantities combine to make 0. *For example, a hydrogen atom has 0 charge because its two constituents are oppositely charged.*
- b. Understand  $p + q$  as the number located a distance  $|q|$  from  $p$ , in the positive or negative direction depending on whether  $q$  is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts.
- c. Understand subtraction of rational numbers as adding the additive inverse,  $p - q = p + (-q)$ . Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.
- d. Apply properties of operations as strategies to add and subtract rational numbers.

[MAFS.7.NS.1.1:](#)

**Remarks/Examples:  
Fluency Expectations or Examples of Culminating Standards**

Adding, subtracting, multiplying, and dividing rational numbers is the culmination of numerical work with the four basic operations. The number system will continue to develop in grade 8, expanding to become the real numbers by the introduction of irrational numbers, and will develop further in high school, expanding to become the complex numbers with the introduction of imaginary numbers. Because there are no specific standards for rational number arithmetic in later grades and because so much other work in grade 7 depends on rational number arithmetic, fluency with rational number arithmetic should be the goal in grade 7.

Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.

[MAFS.7.NS.1.2:](#)

- a. Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the

distributive property, leading to products such as  $(-1)(-1) = 1$  and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts.

- b. Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If  $p$  and  $q$  are integers, then  $-(p/q) = (-p)/q = p/(-q)$ . Interpret quotients of rational numbers by describing real-world contexts.
- c. Apply properties of operations as strategies to multiply and divide rational numbers.
- d. Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.

**Remarks/Examples:**

**Fluency Expectations or Examples of Culminating Standards**

Adding, subtracting, multiplying, and dividing rational numbers is the culmination of numerical work with the four basic operations. The number system will continue to develop in grade 8, expanding to become the real numbers by the introduction of irrational numbers, and will develop further in high school, expanding to become the complex numbers with the introduction of imaginary numbers. Because there are no specific standards for rational number arithmetic in later grades and because so much other work in grade 7 depends on rational number arithmetic, fluency with rational number arithmetic should be the goal in grade 7.

Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.

[MAFS.7.EE.2.4:](#)

- a. Solve word problems leading to equations of the form  $px + q = r$  and  $p(x + q) = r$ , where  $p$ ,  $q$ , and  $r$  are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. *For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?*
- b. Solve word problems leading to inequalities of the form  $px + q > r$  or  $px + q < r$ , where  $p$ ,  $q$ , and  $r$  are specific rational numbers. Graph the solution set of the inequality and

interpret it in the context of the problem. *For example: As a salesperson, you are paid \$50 per week plus \$3 per sale. This week you want your pay to be at least \$100. Write an inequality for the number of sales you need to make, and describe the solutions.*

**Remarks/Examples:  
Fluency Expectations or Examples of Culminating Standards**

In solving word problems leading to one-variable equations of the form  $px + q = r$  and  $p(x + q) = r$ , students solve the equations fluently. This will require fluency with rational number arithmetic (7.NS.1.1–1.3), as well as fluency to some extent with applying properties operations to rewrite linear expressions with rational coefficients (7.EE.1.1).

**Examples of Opportunities for In-Depth Focus**

Work toward meeting this standard builds on the work that led to meeting 6.EE.2.7 and prepares students for the work that will lead to meeting 8.EE.3.7.

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|---------------------------------------|--|
| <p><a href="#">MAFS.8.NS.1.1:</a></p> | <p>Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.</p>   |
| <p><a href="#">MAFS.8.NS.1.2:</a></p> | <p>Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., <math>\pi^2</math>). <i>For example, by truncating the decimal expansion of <math>\sqrt{2}</math>, show that <math>\sqrt{2}</math> is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.</i></p> |
| <p><a href="#">MAFS.8.EE.1.1:</a></p> | <p>Know and apply the properties of integer exponents to generate equivalent numerical expressions. <i>For example, <math>3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27</math></i></p>   |
| <p><a href="#">MAFS.8.EE.1.4:</a></p> | <p>Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.</p>  |

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| <p><a href="#">MAFS.8.EE.2.5:</a></p>     | <p>Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. <i>For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.</i></p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>Remarks/Examples:</b><br/> <b>Examples of Opportunities for In-Depth Focus</b></p> <p>When students work toward meeting this standard, they build on grades 6–7 work with proportions and position themselves for grade 8 work with functions and the equation of a line.</p> </div> |
| <p><a href="#">MAFS.8.F.2.4:</a></p>      | <p>Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.</p>   |
| <p><a href="#">MAFS.912.N-RN.1.1:</a></p> | <p>Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. <i>For example, we define <math>5^{1/3}</math> to be the cube root of 5 because we want <math>(5^{1/3})^3 = 5^{(1/3)3}</math> to hold, so <math>(5^{1/3})^3</math> must equal 5.</i></p>   |
| <p><a href="#">MAFS.912.N-RN.1.2:</a></p> | <p>Rewrite expressions involving radicals and rational exponents using the properties of exponents.</p>  |
| <p><a href="#">MAFS.912.N-RN.2.3:</a></p> | <p>Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.</p>   |
| <p><a href="#">MAFS.912.N-Q.1.1:</a></p>  | <p>Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. ★</p>   |
| <p><a href="#">MAFS.912.N-Q.1.2:</a></p>  | <p>Define appropriate quantities for the purpose of descriptive modeling. ★</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>Remarks/Examples:</b><br/> <b>Algebra 1 Content Notes:</b></p> </div>   |



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|  | <p>Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions.</p>   |
| <p><a href="#">MAFS.912.N-Q.1.3:</a></p>   | <p>Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. ★</p>  |
| <p><a href="#">MAFS.912.A-SSE.1.1:</a></p> | <p>Interpret expressions that represent a quantity in terms of its context. ★</p> <p>a. Interpret parts of an expression, such as terms, factors, and coefficients.</p> <p>b. Interpret complicated expressions by viewing one or more of their parts as a single entity. <i>For example, interpret <math>P(1+r)^n</math> as the product of <math>P</math> and a factor not depending on <math>P</math>.</i></p>  |
| <p><a href="#">MAFS.912.A-SSE.1.2:</a></p> | <p>Use the structure of an expression to identify ways to rewrite it. <i>For example, see <math>x^4 - y^4</math> as <math>(x^2)^2 - (y^2)^2</math>, thus recognizing it as a difference of squares that can be factored as <math>(x^2 - y^2)(x^2 + y^2)</math>.</i></p>   |
| <p><a href="#">MAFS.912.A-SSE.2.3:</a></p> | <p>Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. ★</p> <p>a. Factor a quadratic expression to reveal the zeros of the function it defines.</p> <p>b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.</p> <p>c. Use the properties of exponents to transform expressions for exponential functions. <i>For example the expression <math>1.15^t</math> can be rewritten as <math>(1.15^{1/12})^{12t} \approx 1.012^{12t}</math> to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.</i></p> |
| <p><a href="#">MAFS.912.A-APR.1.1:</a></p> | <p>Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/> <b>Algebra 1 - Fluency Recommendations</b></p> <p>Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in algebra, as well as</p> </div>   |

in their symbolic work with functions. Manipulation can be more mindful when it is fluent.

[MAFS.912.A-APR.2.3:](#)

Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.

[MAFS.912.A-APR.3.4:](#)

Prove polynomial identities and use them to describe numerical relationships. For example, the polynomial identity  $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$  can be used to generate Pythagorean triples.

[MAFS.912.A-APR.4.6:](#)

Rewrite simple rational expressions in different forms; write  $a(x)/b(x)$  in the form  $q(x) + r(x)/b(x)$ , where  $a(x)$ ,  $b(x)$ ,  $q(x)$ , and  $r(x)$  are polynomials with the degree of  $r(x)$  less than the degree of  $b(x)$ , using inspection, long division, or, for the more complicated examples, a computer algebra system.

[MAFS.912.A-APR.4.7:](#)

Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.

[MAFS.912.A-CED.1.1:](#)

Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational, absolute, and exponential functions. ★

[MAFS.912.A-CED.1.2:](#)

Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. ★

[MAFS.912.A-CED.1.3:](#)

Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.* ★

[MAFS.912.A-CED.1.4:](#)

Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law  $V = IR$  to highlight resistance  $R$ .* ★

[MAFS.912.A-REL.1.1:](#)

Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

[MAFS.912.A-REL.1.2:](#)

Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

[MAFS.912.A-REL.2.3:](#)

Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

Solve quadratic equations in one variable.

- a. Use the method of completing the square to transform any quadratic equation in  $x$  into an equation of the form  $(x - p)^2 = q$  that has the same solutions. Derive the quadratic formula from this form.
- b. Solve quadratic equations by inspection (e.g., for  $x^2 = 49$ ), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as  $a \pm bi$  for real numbers  $a$  and  $b$ .

[MAFS.912.A-REI.2.4:](#)

[MAFS.912.A-REI.3.5:](#)

Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.

[MAFS.912.A-REI.3.6:](#)

Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

[MAFS.912.A-REI.4.10:](#)

Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

[MAFS.912.A-REI.4.11:](#)

Explain why the  $x$ -coordinates of the points where the graphs of the equations  $y = f(x)$  and  $y = g(x)$  intersect are the solutions of the equation  $f(x) = g(x)$ ; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where  $f(x)$  and/or  $g(x)$  are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. ★

[MAFS.912.F-IF.1.1:](#)

Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If  $f$  is a function and  $x$  is an element of its domain, then  $f(x)$  denotes the output of  $f$  corresponding to the input  $x$ . The graph of  $f$  is the graph of the equation  $y = f(x)$ .

[MAFS.912.F-IF.2.4:](#)

For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.* ★

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| <a href="#">MAFS.912.F-IF.2.5:</a> | <p>Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. <i>For example, if the function <math>h(n)</math> gives the number of person-hours it takes to assemble engines in a factory, then the positive integers would be an appropriate domain for the function.</i> ★</p>   |
| <a href="#">MAFS.912.F-IF.2.6:</a> | <p>Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. ★</p>   |
| <a href="#">MAFS.912.F-IF.3.7:</a> | <p>Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★</p> <ol style="list-style-type: none"> <li>Graph linear and quadratic functions and show intercepts, maxima, and minima.</li> <li>Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.</li> <li>Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.</li> <li>Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.</li> <li>Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.</li> </ol> |
| <a href="#">MAFS.912.F-IF.3.8:</a> | <p>Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.</p> <ol style="list-style-type: none"> <li>Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.</li> <li>Use the properties of exponents to interpret expressions for exponential functions. <i>For example, identify percent rate of change in functions such as <math>y = (1.02)^t</math>, <math>y = (0.97)^t</math>, <math>y = (1.01)^{2t}</math>, <math>y = (1.2)^{t/10}</math>, and classify them as representing exponential growth or decay.</i></li> </ol>  |
| <a href="#">MAFS.912.F-BF.1.1:</a> | <p>Write a function that describes a relationship between two</p>   |

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|  | <p>quantities. ★</p> <ol style="list-style-type: none"> <li>Determine an explicit expression, a recursive process, or steps for calculation from a context.</li> <li>Combine standard function types using arithmetic operations. <i>For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.</i></li> <li>Compose functions. <i>For example, if <math>T(y)</math> is the temperature in the atmosphere as a function of height, and <math>h(t)</math> is the height of a weather balloon as a function of time, then <math>T(h(t))</math> is the temperature at the location of the weather balloon as a function of time.</i></li> </ol> |
| <p><a href="#">MAFS.912.F-BF.2.3:</a></p>  | <p>Identify the effect on the graph of replacing <math>f(x)</math> by <math>f(x) + k</math>, <math>k f(x)</math>, <math>f(kx)</math>, and <math>f(x + k)</math> for specific values of <math>k</math> (both positive and negative); find the value of <math>k</math> given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. <i>Include recognizing even and odd functions from their graphs and algebraic expressions for them.</i></p>  |
| <p><a href="#">MAFS.912.G-GPE.2.5:</a></p> | <p>Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).</p> <div style="border: 1px solid black; padding: 10px;"> <p><b>Remarks/Examples:</b><br/> <b>Geometry - Fluency Recommendations</b></p> <p>Fluency with the use of coordinates to establish geometric results, calculate length and angle, and use geometric representations as a modeling tool are some of the most valuable tools in mathematics and related fields.</p> </div>  |
| <p><a href="#">MAFS.912.G-GPE.2.6:</a></p> | <p>Find the point on a directed line segment between two given points that partitions the segment in a given ratio.</p>   |
| <p><a href="#">MAFS.912.G-GPE.2.7:</a></p> | <p>Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula. ★</p> <div style="border: 1px solid black; padding: 10px;"> <p><b>Remarks/Examples:</b><br/> <b>Geometry - Fluency Recommendations</b></p> <p>Fluency with the use of coordinates to establish geometric</p> </div>  |

results, calculate length and angle, and use geometric representations as a modeling tool are some of the most valuable tools in mathematics and related fields.

[MAFS.912.S-ID.2.5:](#)

Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. ★

[MAFS.912.S-ID.2.6:](#)

Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. ★

- a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear, and exponential models.*
- b. Informally assess the fit of a function by plotting and analyzing residuals.
- c. Fit a linear function for a scatter plot that suggests a linear association.

**Remarks/Examples:**

Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals.

[MAFS.912.S-ID.3.7:](#)

Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. ★

[MAFS.K12.MP.1.1:](#)

**Make sense of problems and persevere in solving them.**

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing

calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

**Reason abstractly and quantitatively.**

[MAFS.K12.MP.2.1:](#)

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

**Construct viable arguments and critique the reasoning of others.**

[MAFS.K12.MP.3.1:](#)

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made

formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

**Model with mathematics.**

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another.

[MAFS.K12.MP.4.1:](#) Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

**Use appropriate tools strategically.**

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data.

[MAFS.K12.MP.5.1:](#) Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve



problems. They are able to use technological tools to explore and deepen their understanding of concepts.

**Attend to precision.**

[MAFS.K12.MP.6.1:](#)

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

**Look for and make use of structure.**

[MAFS.K12.MP.7.1:](#)

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

**Look for and express regularity in repeated reasoning.**

[MAFS.K12.MP.8.1:](#)

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,

$(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.AC.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.

## M/J Mathematics Transfer (#1200220)

**Version for Academic Year:** 2015 - 2016

**Course Number:** 1200220

**Abbreviated Title:** M/J MATH TRAN

**Course Length:** Year (Y)

**Course Level:** 2

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 6,7,8

### GENERAL NOTES

#### **English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

### COURSE STANDARDS

| Name                              | Description  |
|-----------------------------------|--|
| <a href="#">ELD.K12.ELL.1.1:</a>  | English language learners communicate for social and instructional purposes within the school setting.                                   |
| <a href="#">ELD.K12.ELL.AC.1:</a> | English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics. |

## **Algebra 1 for Credit Recovery (#1200315)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 1200315

**Abbreviated Title:** ALG 1 CR

**Number of Credits:** One credit (1)

**Course Length:** Year (Y)

**Course Type:** Elective

**Course Level:** 2

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 9,10,11,12

### **VERSION DESCRIPTION**

Credit Recovery courses are credit bearing courses with specific content requirements defined by Next Generation Sunshine State Standards and/or Florida Standards. Students enrolled in a Credit Recovery course must have previously attempted the corresponding course (and/or End-of-Course assessment) since the course requirements for the Credit Recovery course is exactly the same as the previously attempted corresponding course. For example, Geometry (1206310) and Geometry for Credit Recovery (1206315) have identical content requirements. It is important to note that Credit Recovery courses are not bound by Section 1003.436(1) (a), Florida Statutes, requiring a minimum of 135 hours of bona fide instruction (120 hours in a school/district implementing block scheduling) in a designed course of study that contains student performance standards, since the students have previously attempted successful completion of the corresponding course. Additionally, Credit Recovery courses should ONLY be used for credit recovery, grade forgiveness, or remediation for students needing to prepare for an End-of-Course assessment retake.

### **GENERAL NOTES**

The fundamental purpose of this course is to formalize and extend the mathematics that students learned in the middle grades. The critical areas, called units, deepen and extend understanding of linear and exponential relationships by contrasting them with each other and by applying linear models to data that exhibit a linear trend, and students engage in methods for analyzing, solving, and using quadratic functions. The Standards for Mathematical Practice apply throughout each course and, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations.

**Unit 1- Relationships Between Quantities and Reasoning with Equations:** By the end of eighth grade, students have learned to solve linear equations in one variable and have applied graphical and algebraic methods to analyze and solve systems of linear equations in two variables. Now, students analyze and explain the process of solving an equation. Students develop fluency writing, interpreting, and translating between various forms of

linear equations and inequalities, and using them to solve problems. They master the solution of linear equations and apply related solution techniques and the laws of exponents to the creation and solution of simple exponential equations.

**Unit 2- Linear and Exponential Relationships:** In earlier grades, students define, evaluate, and compare functions, and use them to model relationships between quantities. In this unit, students will learn function notation and develop the concepts of domain and range. They explore many examples of functions, including sequences; they interpret functions given graphically, numerically, symbolically, and verbally, translate between representations, and understand the limitations of various representations. Students build on and informally extend their understanding of integer exponents to consider exponential functions. They compare and contrast linear and exponential functions, distinguishing between additive and multiplicative change. Students explore systems of equations and inequalities, and they find and interpret their solutions. They interpret arithmetic sequences as linear functions and geometric sequences as exponential functions.

**Unit 3- Descriptive Statistics:** This unit builds upon students prior experiences with data, providing students with more formal means of assessing how a model fits data. Students use regression techniques to describe and approximate linear relationships between quantities. They use graphical representations and knowledge of the context to make judgments about the appropriateness of linear models. With linear models, they look at residuals to analyze the goodness of fit.

**Unit 4- Expressions and Equations:** In this unit, students build on their knowledge from unit 2, where they extended the laws of exponents to rational exponents. Students apply this new understanding of number and strengthen their ability to see structure in and create quadratic and exponential expressions. They create and solve equations, inequalities, and systems of equations involving quadratic expressions.

**Unit 5- Quadratic Functions and Modeling:** In this unit, students consider quadratic functions, comparing the key characteristics of quadratic functions to those of linear and exponential functions. They select from among these functions to model phenomena. Students learn to anticipate the graph of a quadratic function by interpreting various forms of quadratic expressions. In particular, they identify the real solutions of a quadratic equation as the zeros of a related quadratic function. Students expand their experience with functions to include more specialized functions absolute value, step, and those that are piece wise-defined.

### English Language Development ELD Standards Special Notes Section:

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

### COURSE STANDARDS

| Name                               | Description   |
|------------------------------------|---|
| <a href="#">MAFS.912.N-RN.1.1:</a> | Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. <i>For example, we define <math>5^{1/3}</math> to be the cube root of 5 because we want <math>(5^{1/3})^3 = 5^{(1/3)3}</math> to hold, so <math>(5^{1/3})^3</math> must equal 5.</i> |
| <a href="#">MAFS.912.N-RN.1.2:</a> | Rewrite expressions involving radicals and rational exponents using the properties of exponents.  |
| <a href="#">MAFS.912.N-RN.2.3:</a> | Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.   |
| <a href="#">MAFS.912.N-Q.1.1:</a>  | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. ★   |
| <a href="#">MAFS.912.N-Q.1.2:</a>  | Define appropriate quantities for the purpose of descriptive modeling. ★<br><br><b>Remarks/Examples:</b><br><br><b>Algebra 1 Content Notes:</b>   |

Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions.

[MAFS.912.N-Q.1.3:](#)

Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. ★

Interpret expressions that represent a quantity in terms of its context. ★

[MAFS.912.A-SSE.1.1:](#)

- Interpret parts of an expression, such as terms, factors, and coefficients.
- Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example,*

*interpret  $P(1+r)^n$  as the product of  $P$  and a factor not depending on  $P$ .*

[MAFS.912.A-SSE.1.2:](#)

Use the structure of an expression to identify ways to rewrite it. *For example, see  $x^4 - y^4$  as  $(x^2)^2 - (y^2)^2$ , thus recognizing it as a difference of squares that can be factored as  $(x^2 - y^2)(x^2 + y^2)$ .*

Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. ★

[MAFS.912.A-SSE.2.3:](#)

- Factor a quadratic expression to reveal the zeros of the function it defines.
- Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
- Use the properties of exponents to transform expressions for exponential functions. *For example the*

*expression  $1.15^t$  can be rewritten as  $(1.15^{1/12})^{12t} \approx 1.012^{12t}$  to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*

[MAFS.912.A-APR.1.1:](#)

Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.

**Remarks/Examples:**  
**Algebra 1 - Fluency Recommendations**

Fluency in adding, subtracting, and multiplying polynomials

|  |   |
|--|---|
|  | <p>supports students throughout their work in algebra, as well as in their symbolic work with functions. Manipulation can be more mindful when it is fluent.</p>  |
| <p><a href="#">MAFS.912.A-APR.2.3:</a></p> | <p>Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.</p>  |
| <p><a href="#">MAFS.912.A-CED.1.1:</a></p> | <p>Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational, absolute, and exponential functions. ★</p>   |
| <p><a href="#">MAFS.912.A-CED.1.2:</a></p> | <p>Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. ★</p>  |
| <p><a href="#">MAFS.912.A-CED.1.3:</a></p> | <p>Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. <i>For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.</i> ★</p>   |
| <p><a href="#">MAFS.912.A-CED.1.4:</a></p> | <p>Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. <i>For example, rearrange Ohm's law <math>V = IR</math> to highlight resistance <math>R</math>.</i> ★</p>  |
| <p><a href="#">MAFS.912.A-REL.1.1:</a></p> | <p>Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.</p>  |
| <p><a href="#">MAFS.912.A-REL.2.3:</a></p> | <p>Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.</p>   |
| <p><a href="#">MAFS.912.A-REL.2.4:</a></p> | <p>Solve quadratic equations in one variable.</p> <ol style="list-style-type: none"> <li>Use the method of completing the square to transform any quadratic equation in <math>x</math> into an equation of the form <math>(x - p)^2 = q</math> that has the same solutions. Derive the quadratic formula from this form.</li> <li>Solve quadratic equations by inspection (e.g., for <math>x^2 = 49</math>), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as <math>a \pm bi</math> for real numbers <math>a</math> and <math>b</math>.</li> </ol> |



|                                      |   |
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| <a href="#">MAFS.912.A-REL.3.5:</a>  | Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.   |
| <a href="#">MAFS.912.A-REL.3.6:</a>  | Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.  |
| <a href="#">MAFS.912.A-REL.4.10:</a> | Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).   |
| <a href="#">MAFS.912.A-REL.4.11:</a> | Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$ ; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. ★ |
| <a href="#">MAFS.912.A-REL.4.12:</a> | Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.   |
| <a href="#">MAFS.912.F-IF.1.1:</a>   | Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If $f$ is a function and $x$ is an element of its domain, then $f(x)$ denotes the output of $f$ corresponding to the input $x$ . The graph of $f$ is the graph of the equation $y = f(x)$ .   |
| <a href="#">MAFS.912.F-IF.1.2:</a>   | Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.   |
| <a href="#">MAFS.912.F-IF.1.3:</a>   | Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by $f(0) = f(1) = 1$ , $f(n+1) = f(n) + f(n-1)$ for $n \geq 1$ .  |
| <a href="#">MAFS.912.F-IF.2.4:</a>   | For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. <i>Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</i> ★               |

|   |   |
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| <p><a href="#">MAFS.912.F-IF.2.5:</a></p> | <p>Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. <i>For example, if the function <math>h(n)</math> gives the number of person-hours it takes to assemble engines in a factory, then the positive integers would be an appropriate domain for the function.</i> ★</p>   |
| <p><a href="#">MAFS.912.F-IF.2.6:</a></p> | <p>Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. ★</p>   |
| <p><a href="#">MAFS.912.F-IF.3.8:</a></p> | <p>Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.</p> <ol style="list-style-type: none"> <li>Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.</li> <li>Use the properties of exponents to interpret expressions for exponential functions. <i>For example, identify percent rate of change in functions such as <math>y = (1.02)^t</math>, <math>y = (0.97)^t</math>, <math>y = (1.01)^{2t}</math>, <math>y = (1.2)^{t/10}</math>, and classify them as representing exponential growth or decay.</i></li> </ol>  |
| <p><a href="#">MAFS.912.F-IF.3.9:</a></p> | <p>Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). <i>For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.</i></p>   |
| <p><a href="#">MAFS.912.F-BF.1.1:</a></p> | <p>Write a function that describes a relationship between two quantities. ★</p> <ol style="list-style-type: none"> <li>Determine an explicit expression, a recursive process, or steps for calculation from a context.</li> <li>Combine standard function types using arithmetic operations. <i>For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.</i></li> <li>Compose functions. <i>For example, if <math>T(y)</math> is the temperature in the atmosphere as a function of height, and <math>h(t)</math> is the height of a weather balloon as a function of time, then <math>T(h(t))</math> is the temperature at the location of the</i></li> </ol> |

|                                    |   |
|------------------------------------|---|
|                                    | <i>weather balloon as a function of time.</i>   |
| <a href="#">MAFS.912.F-BF.2.3:</a> | Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$ , $kf(x)$ , $f(kx)$ , and $f(x + k)$ for specific values of $k$ (both positive and negative); find the value of $k$ given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. <i>Include recognizing even and odd functions from their graphs and algebraic expressions for them.</i>  |
| <a href="#">MAFS.912.F-LE.1.1:</a> | Distinguish between situations that can be modeled with linear functions and with exponential functions. ★<br><br><ul style="list-style-type: none"> <li>a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.</li> <li>b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.</li> <li>c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.</li> </ul> |
| <a href="#">MAFS.912.F-LE.1.2:</a> | Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). ★   |
| <a href="#">MAFS.912.F-LE.1.3:</a> | Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. ★  |
| <a href="#">MAFS.912.F-LE.2.5:</a> | Interpret the parameters in a linear or exponential function in terms of a context. ★   |
| <a href="#">MAFS.912.S-ID.1.1:</a> | Represent data with plots on the real number line (dot plots, histograms, and box plots). ★<br><br><div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/> In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.</p> </div>   |
| <a href="#">MAFS.912.S-ID.1.2:</a> | Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. ★  |

**Remarks/Examples:**

In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.

[MAFS.912.S-ID.1.3:](#)

Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). ★

**Remarks/Examples:**

In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.

[MAFS.912.S-ID.2.5:](#)

Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. ★

[MAFS.912.S-ID.2.6:](#)

Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. ★

- a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear, and exponential models.*
- b. Informally assess the fit of a function by plotting and analyzing residuals.
- c. Fit a linear function for a scatter plot that suggests a linear association.

**Remarks/Examples:**

Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals.

[MAFS.912.S-ID.3.7:](#)

Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. ★

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| <a href="#">MAFS.912.S-ID.3.8:</a> | Compute (using technology) and interpret the correlation coefficient of a linear fit. ★   |
| <a href="#">MAFS.912.S-ID.3.9:</a> | Distinguish between correlation and causation. ★  |
| <a href="#">LAFS.910.SL.1.1:</a>   | <p>Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.</p> <ol style="list-style-type: none"> <li>Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.</li> <li>Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed.</li> <li>Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.</li> <li>Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.</li> </ol> |
| <a href="#">LAFS.910.SL.1.2:</a>   | Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.  |
| <a href="#">LAFS.910.SL.1.3:</a>   | Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.   |
| <a href="#">LAFS.910.SL.2.4:</a>   | Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.   |
| <a href="#">LAFS.910.RST.1.3:</a>  | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.   |
| <a href="#">LAFS.910.RST.2.4:</a>  | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.   |

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|------------------------------------|---|
| <a href="#">LAFS.910.RST.3.7:</a>  | Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.  |
| <a href="#">LAFS.910.WHST.1.1:</a> | <p>Write arguments focused on <i>discipline-specific content</i>.</p> <ol style="list-style-type: none"> <li>a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.</li> <li>b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience’s knowledge level and concerns.</li> <li>c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.</li> <li>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.</li> <li>e. Provide a concluding statement or section that follows from or supports the argument presented.</li> </ol> |
| <a href="#">LAFS.910.WHST.2.4:</a> | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.  |
| <a href="#">LAFS.910.WHST.3.9:</a> | Draw evidence from informational texts to support analysis, reflection, and research.   |
| <a href="#">MAFS.K12.MP.1.1:</a>   | <p><b>Make sense of problems and persevere in solving them.</b></p> <p>Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences</p>  |

between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

**Reason abstractly and quantitatively.**

[MAFS.K12.MP.2.1:](#)

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

**Construct viable arguments and critique the reasoning of others.**

[MAFS.K12.MP.3.1:](#)

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument

applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

**Model with mathematics.**

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another.

[MAFS.K12.MP.4.1:](#)

Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

**Use appropriate tools strategically.**

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

[MAFS.K12.MP.5.1:](#)



**Attend to precision.**

[MAFS.K12.MP.6.1:](#)

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

**Look for and make use of structure.**

[MAFS.K12.MP.7.1:](#)

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

**Look for and express regularity in repeated reasoning.**

[MAFS.K12.MP.8.1:](#)

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students

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|  | maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.                                   |
| <a href="#"><u>ELD.K12.ELL.1.1:</u></a>    | English language learners communicate for social and instructional purposes within the school setting.   |
| <a href="#"><u>ELD.K12.ELL.AC.1:</u></a>   | English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.   |
| <a href="#"><u>MAFS.912.F-IF.3.7a:</u></a> | a. Graph linear and quadratic functions and show intercepts, maxima, and minima.   |
| <a href="#"><u>MAFS.912.F-IF.3.7b:</u></a> | b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.   |
| <a href="#"><u>MAFS.912.F-IF.3.7c:</u></a> | c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.   |
| <a href="#"><u>MAFS.912.F-IF.3.7e:</u></a> | e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift. |

## **Algebra 2 for Credit Recovery (#1200335)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 1200335

**Abbreviated Title:** ALG 2 CR

**Number of Credits:** One credit (1)

**Course Type:** Elective

**Course Level:** 2

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 9,10,11,12

### **VERSION DESCRIPTION**

Special notes: Credit Recovery courses are credit bearing courses with specific content requirements defined by Next Generation Sunshine State Standards and/or Florida Standards. Students enrolled in a Credit Recovery course must have previously attempted the corresponding course (and/or End-of-Course assessment) since the course requirements for the Credit Recovery course are exactly the same as the previously attempted corresponding course. For example, Geometry (1206310) and Geometry for Credit Recovery (1206315) have identical content requirements. It is important to note that Credit Recovery courses are not bound by Section 1003.436(1)(a), Florida Statutes, requiring a minimum of 135 hours of bona fide instruction (120 hours in a school/district implementing block scheduling) in a designed course of study that contains student performance standards, since the students have previously attempted successful completion of the corresponding course. Additionally, Credit Recovery courses should ONLY be used for credit recovery, grade forgiveness, or remediation for students needing to prepare for an End-of-Course assessment retake.

### **GENERAL NOTES**

Building on their work with linear, quadratic, and exponential functions, students extend their repertoire of functions to include polynomial, rational, and radical functions.<sup>2</sup> Students work closely with the expressions that define the functions, and continue to expand and hone their abilities to model situations and to solve equations, including solving quadratic equations over the set of complex numbers and solving exponential equations using the properties of logarithms. The Standards for Mathematical Practice apply throughout each course and, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations. The critical areas for this course, organized into four units, are as follows:

**Unit 1- Polynomial, Rational, and Radical Relationships:** This unit develops the structural similarities between the system of polynomials and the system of integers. Students draw on analogies between polynomial arithmetic and base-ten computation, focusing on properties of operations, particularly the distributive property. Students

connect multiplication of polynomials with multiplication of multi-digit integers, and division of polynomials with long division of integers. Students identify zeros of polynomials, including complex zeros of quadratic polynomials, and make connections between zeros of polynomials and solutions of polynomial equations. The unit culminates with the fundamental theorem of algebra. A central theme of this unit is that the arithmetic of rational expressions is governed by the same rules as the arithmetic of rational numbers.

**Unit 2- Trigonometric Functions:** Building on their previous work with functions, and on their work with trigonometric ratios and circles in Geometry, students now use the coordinate plane to extend trigonometry to model periodic phenomena.

**Unit 3- Modeling with Functions:** In this unit students synthesize and generalize what they have learned about a variety of function families. They extend their work with exponential functions to include solving exponential equations with logarithms. They explore the effects of transformations on graphs of diverse functions, including functions arising in an application, in order to abstract the general principle that transformations on a graph always have the same effect regardless of the type of the underlying function. They identify appropriate types of functions to model a situation, they adjust parameters to improve the model, and they compare models by analyzing appropriateness of fit and making judgments about the domain over which a model is a good fit. The description of modeling as “the process of choosing and using mathematics and statistics to analyze empirical situations, to understand them better, and to make decisions” is at the heart of this unit. The narrative discussion and diagram of the modeling cycle should be considered when knowledge of functions, statistics, and geometry is applied in a modeling context.

**Unit 4- Inferences and Conclusions from Data:** In this unit, students see how the visual displays and summary statistics they learned in earlier grades relate to different types of data and to probability distributions. They identify different ways of collecting data—including sample surveys, experiments, and simulations—and the role that randomness and careful design play in the conclusions that can be drawn.

**Unit 5- Applications of Probability:** Building on probability concepts that began in the middle grades, students use the languages of set theory to expand their ability to compute and interpret theoretical and experimental probabilities for compound events, attending to mutually exclusive events, independent events, and conditional probability. Students should make use of geometric probability models wherever possible. They use probability to make informed decisions.

**English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or

produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

## VERSION REQUIREMENTS

### Fluency Recommendations

**A-APR.6** This standard sets an expectation that students will divide polynomials with remainder by inspection in simple cases. For example, one can view the rational

expression  $\frac{2x^2 + 3x - 1}{x^2 + 2x + 1}$ .

**A-SSE.2** The ability to see structure in expressions and to use this structure to rewrite expressions is a key skill in everything from advanced factoring (e.g., grouping) to summing series to the rewriting of rational expressions to examine the end behavior of the corresponding rational function.

**F-IF.3** Fluency in translating between recursive definitions and closed forms is helpful when dealing with many problems involving sequences and series, with applications ranging from fitting functions to tables to problems in finance.

## COURSE STANDARDS

| Name                               | Description   |
|------------------------------------|---|
| <a href="#">MAFS.912.N-RN.1.1:</a> | Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. For example, we define $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3)3}$ to hold, so $(5^{1/3})^3$ must equal 5. |
| <a href="#">MAFS.912.N-RN.1.2:</a> | Rewrite expressions involving radicals and rational exponents using the properties of exponents.  |
| <a href="#">MAFS.912.N-Q.1.2:</a>  | Define appropriate quantities for the purpose of descriptive  |

modeling. ★

**Remarks/Examples:**

**Algebra 1 Content Notes:**

Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions.

[MAFS.912.N-CN.1.1:](#)

Know there is a complex number  $i$  such that  $i^2 = -1$ , and every complex number has the form  $a + bi$  with  $a$  and  $b$  real.

[MAFS.912.N-CN.1.2:](#)

Use the relation  $i^2 = -1$  and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.

[MAFS.912.N-CN.3.7:](#)

Solve quadratic equations with real coefficients that have complex solutions.

Interpret expressions that represent a quantity in terms of its context. ★

[MAFS.912.A-SSE.1.1:](#)

- a. Interpret parts of an expression, such as terms, factors, and coefficients.
- b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example,*

*interpret  $P(1+r)^n$  as the product of  $P$  and a factor not depending on  $P$ .*

[MAFS.912.A-SSE.1.2:](#)

Use the structure of an expression to identify ways to rewrite it. *For example, see  $x^4 - y^4$  as  $(x^2)^2 - (y^2)^2$ , thus recognizing it as a difference of squares that can be factored as  $(x^2 - y^2)(x^2 + y^2)$ .*

Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. ★

[MAFS.912.A-SSE.2.3:](#)

- a. Factor a quadratic expression to reveal the zeros of the function it defines.
- b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
- c. Use the properties of exponents to transform expressions for exponential functions. *For example the*

*expression  $1.15^t$  can be rewritten as  $(1.15^{1/2})^{2t} \approx 1.012^{2t}$  to*

reveal the approximate equivalent monthly interest rate if the annual rate is 15%.

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| <a href="#">MAFS.912.A-SSE.2.4:</a> | Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. <i>For example, calculate mortgage payments.</i> ★   |
| <a href="#">MAFS.912.A-APR.1.1:</a> | <p>Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.</p> <div style="border: 1px solid black; padding: 10px;"> <p><b>Remarks/Examples:</b><br/> <b>Algebra 1 - Fluency Recommendations</b></p> <p>Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in algebra, as well as in their symbolic work with functions. Manipulation can be more mindful when it is fluent.</p> </div> |
| <a href="#">MAFS.912.A-APR.2.2:</a> | Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number $a$ , the remainder on division by $x - a$ is $p(a)$ , so $p(a) = 0$ if and only if $(x - a)$ is a factor of $p(x)$ .  |
| <a href="#">MAFS.912.A-APR.2.3:</a> | Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.   |
| <a href="#">MAFS.912.A-APR.3.4:</a> | Prove polynomial identities and use them to describe numerical relationships. For example, the polynomial identity $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ can be used to generate Pythagorean triples.   |
| <a href="#">MAFS.912.A-APR.4.6:</a> | Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x) + r(x)/b(x)$ , where $a(x)$ , $b(x)$ , $q(x)$ , and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$ , using inspection, long division, or, for the more complicated examples, a computer algebra system.  |
| <a href="#">MAFS.912.A-CED.1.1:</a> | Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational, absolute, and exponential functions. ★  |
| <a href="#">MAFS.912.A-CED.1.2:</a> | Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. ★   |
| <a href="#">MAFS.912.A-CED.1.3:</a> | Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. <i>For</i>  |

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|                                      | <p><i>example, represent inequalities describing nutritional and cost constraints on combinations of different foods. ★</i></p>   |
| <a href="#">MAFS.912.A-CED.1.4:</a>  | <p>Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. <i>For example, rearrange Ohm's law <math>V = IR</math> to highlight resistance <math>R</math>. ★</i></p>  |
| <a href="#">MAFS.912.A-REI.1.1:</a>  | <p>Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.</p>  |
| <a href="#">MAFS.912.A-REI.1.2:</a>  | <p>Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.</p>   |
| <a href="#">MAFS.912.A-REI.2.4:</a>  | <p>Solve quadratic equations in one variable.</p> <ol style="list-style-type: none"> <li>Use the method of completing the square to transform any quadratic equation in <math>x</math> into an equation of the form <math>(x - p)^2 = q</math> that has the same solutions. Derive the quadratic formula from this form.</li> <li>Solve quadratic equations by inspection (e.g., for <math>x^2 = 49</math>), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as <math>a \pm bi</math> for real numbers <math>a</math> and <math>b</math>.</li> </ol> |
| <a href="#">MAFS.912.A-REI.3.6:</a>  | <p>Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.</p>   |
| <a href="#">MAFS.912.A-REI.3.7:</a>  | <p>Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. <i>For example, find the points of intersection between the line <math>y = -3x</math> and the circle <math>x^2 + y^2 = 3</math>.</i></p>  |
| <a href="#">MAFS.912.A-REI.4.11:</a> | <p>Explain why the <math>x</math>-coordinates of the points where the graphs of the equations <math>y = f(x)</math> and <math>y = g(x)</math> intersect are the solutions of the equation <math>f(x) = g(x)</math>; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where <math>f(x)</math> and/or <math>g(x)</math> are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. ★</p>   |
| <a href="#">MAFS.912.F-IF.2.4:</a>   | <p>For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a</p>   |



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|   | <p>verbal description of the relationship. <i>Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</i> ★</p>   |
| <p><a href="#">MAFS.912.F-IF.2.5:</a></p> | <p>Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. <i>For example, if the function <math>h(n)</math> gives the number of person-hours it takes to assemble engines in a factory, then the positive integers would be an appropriate domain for the function.</i> ★</p>   |
| <p><a href="#">MAFS.912.F-IF.2.6:</a></p> | <p>Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. ★</p>   |
| <p><a href="#">MAFS.912.F-IF.3.7:</a></p> | <p>Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★</p> <ol style="list-style-type: none"> <li>Graph linear and quadratic functions and show intercepts, maxima, and minima.</li> <li>Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.</li> <li>Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.</li> <li>Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.</li> <li>Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.</li> </ol> |
| <p><a href="#">MAFS.912.F-IF.3.8:</a></p> | <p>Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.</p> <ol style="list-style-type: none"> <li>Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.</li> <li>Use the properties of exponents to interpret expressions for exponential functions. <i>For example, identify percent rate of change in functions such as <math>y = (1.02)^t</math>, <math>y = (0.97)^t</math>, <math>y =</math></i></li> </ol>   |

$= (1.0)^{2t}$ ,  $y = (1.2)^{t/10}$ , and classify them as representing exponential growth or decay.

[MAFS.912.F-IF.3.9:](#)

Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*

[MAFS.912.F-BF.1.1:](#)

Write a function that describes a relationship between two quantities. ★

- Determine an explicit expression, a recursive process, or steps for calculation from a context.
- Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*
- Compose functions. *For example, if  $T(y)$  is the temperature in the atmosphere as a function of height, and  $h(t)$  is the height of a weather balloon as a function of time, then  $T(h(t))$  is the temperature at the location of the weather balloon as a function of time.*

[MAFS.912.F-BF.1.2:](#)

Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. ★

[MAFS.912.F-BF.2.3:](#)

Identify the effect on the graph of replacing  $f(x)$  by  $f(x) + k$ ,  $k f(x)$ ,  $f(kx)$ , and  $f(x + k)$  for specific values of  $k$  (both positive and negative); find the value of  $k$  given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.*

[MAFS.912.F-BF.2.4:](#)

Find inverse functions.

- Solve an equation of the form  $f(x) = c$  for a simple function  $f$  that has an inverse and write an expression for the inverse. *For example,  $f(x) = 2x^3$  or  $f(x) = (x+1)/(x-1)$  for  $x \neq 1$ .*
- Verify by composition that one function is the inverse of another.
- Read values of an inverse function from a graph or a

- table, given that the function has an inverse.
- d. Produce an invertible function from a non-invertible function by restricting the domain.

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| <a href="#">MAFS.912.F-BF.2.a:</a>  | Use the change of base formula.  |
| <a href="#">MAFS.912.F-LE.1.4:</a>  | For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where $a$ , $c$ , and $d$ are numbers and the base $b$ is 2, 10, or $e$ ; evaluate the logarithm using technology. ★  |
| <a href="#">MAFS.912.F-LE.2.5:</a>  | Interpret the parameters in a linear or exponential function in terms of a context. ★  |
| <a href="#">MAFS.912.F-TF.1.1:</a>  | Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle; Convert between degrees and radians.   |
| <a href="#">MAFS.912.F-TF.1.2:</a>  | Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.  |
| <a href="#">MAFS.912.F-TF.2.5:</a>  | Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline. ★   |
| <a href="#">MAFS.912.F-TF.3.8:</a>  | Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to calculate trigonometric ratios.   |
| <a href="#">MAFS.912.G-GPE.1.2:</a> | Derive the equation of a parabola given a focus and directrix.   |
| <a href="#">MAFS.912.S-ID.1.4:</a>  | Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. ★ |
| <a href="#">MAFS.912.S-IC.1.1:</a>  | Understand statistics as a process for making inferences about population parameters based on a random sample from that population. ★  |
| <a href="#">MAFS.912.S-IC.1.2:</a>  | Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. <i>For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?</i>                       |
| <a href="#">MAFS.912.S-IC.2.3:</a>  | Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. ★   |
| <a href="#">MAFS.912.S-IC.2.4:</a>  | Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling. ★   |

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| <a href="#">MAFS.912.S-IC.2.5:</a> | Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. ★   |
| <a href="#">MAFS.912.S-IC.2.6:</a> | Evaluate reports based on data. ★   |
| <a href="#">MAFS.912.S-CP.1.1:</a> | Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”). ★   |
| <a href="#">MAFS.912.S-CP.1.2:</a> | Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent. ★  |
| <a href="#">MAFS.912.S-CP.1.3:</a> | Understand the conditional probability of A given B as $P(A \text{ and } B)/P(B)$ , and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B. ★  |
| <a href="#">MAFS.912.S-CP.1.4:</a> | Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. <i>For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.</i> ★ |
| <a href="#">MAFS.912.S-CP.1.5:</a> | Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. <i>For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.</i> ★  |
| <a href="#">MAFS.912.S-CP.2.6:</a> | Find the conditional probability of A given B as the fraction of B’s outcomes that also belong to A, and interpret the answer in terms of the model. ★  |
| <a href="#">MAFS.912.S-CP.2.7:</a> | Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ , and interpret the answer in terms of the model. ★   |
| <a href="#">LAFS.1112.SL.1.1:</a>  | Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively. <ul style="list-style-type: none"> <li>a. Come to discussions prepared, having read and</li> </ul>  |

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|                                     | <p>researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.</p> <p>b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.</p> <p>c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.</p> <p>d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task.</p> |
| <a href="#">LAFS.1112.SL.1.2:</a>   | Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.  |
| <a href="#">LAFS.1112.SL.1.3:</a>   | Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used.  |
| <a href="#">LAFS.1112.SL.2.4:</a>   | Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.  |
| <a href="#">LAFS.1112.RST.1.3:</a>  | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.  |
| <a href="#">LAFS.1112.RST.2.4:</a>  | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.   |
| <a href="#">LAFS.1112.RST.3.7:</a>  | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.  |
| <a href="#">LAFS.1112.WHST.1.1:</a> | Write arguments focused on <i>discipline-specific content</i> .  |

- a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.
- b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience’s knowledge level, concerns, values, and possible biases.
- c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.
- d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
- e. Provide a concluding statement or section that follows from or supports the argument presented.

[LAFS.1112.WHST.2.4:](#)

Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

[LAFS.1112.WHST.3.9:](#)

Draw evidence from informational texts to support analysis, reflection, and research.

[MAFS.K12.MP.1.1:](#)

**Make sense of problems and persevere in solving them.**

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables,

and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

**Reason abstractly and quantitatively.**

[MAFS.K12.MP.2.1:](#)

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

**Construct viable arguments and critique the reasoning of others.**

[MAFS.K12.MP.3.1:](#)

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an

argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

**Model with mathematics.**

[MAFS.K12.MP.4.1:](#)

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

**Use appropriate tools strategically.**

[MAFS.K12.MP.5.1:](#)

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of



concepts.

**Attend to precision.**

[MAFS.K12.MP.6.1:](#)

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

**Look for and make use of structure.**

[MAFS.K12.MP.7.1:](#)

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

**Look for and express regularity in repeated reasoning.**

[MAFS.K12.MP.8.1:](#)

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through  $(1, 2)$  with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x$

+ 1),  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.AC.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.

## **Algebra 1-A for Credit Recovery (#1200375)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 1200375

**Abbreviated Title:** ALG 1-A CR

**Course Type:** Elective

**Course Level:** 2

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 9,10,11,12

### **VERSION DESCRIPTION**

Special notes: Credit Recovery courses are credit bearing courses with specific content requirements defined by Next Generation Sunshine State Standards and/or Florida Standards. Students enrolled in a Credit Recovery course must have previously attempted the corresponding course (and/or End-of-Course assessment) since the course requirements for the Credit Recovery course are exactly the same as the previously attempted corresponding course. For example, Geometry (1206310) and Geometry for Credit Recovery (1206315) have identical content requirements. It is important to note that Credit Recovery courses are not bound by Section 1003.436(1)(a), Florida Statutes, requiring a minimum of 135 hours of bona fide instruction (120 hours in a school/district implementing block scheduling) in a designed course of study that contains student performance standards, since the students have previously attempted successful completion of the corresponding course. Additionally, Credit Recovery courses should **ONLY** be used for credit recovery, grade forgiveness, or remediation for students needing to prepare for an End-of-Course assessment retake.

### **GENERAL NOTES**

The fundamental purpose of this course is to formalize and extend the mathematics that students learned in the middle grades. The critical areas, called units, deepen and extend understanding of linear and exponential relationships by contrasting them with each other and by applying linear models to data that exhibit a linear trend, and students engage in methods for analyzing, solving, and using quadratic functions. The Standards for Mathematical Practice apply throughout each course and, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations.

### **Algebra 1A (Year 1)**

**Unit 1-Relationships Between Questions and Reasoning with Equations:** By the end of eighth grade, students have learned to solve linear equations in one variable and have applied graphical and algebraic methods to analyze and solve systems of linear equations in two variables. Now, students analyze and explain the process of solving an equation. Students develop fluency writing, interpreting, and translating between various forms of

linear equations and inequalities, and using them to solve problems. They master the solution of linear equations and apply related solution techniques and the laws of exponents to the creation and solution of simple exponential equations.

**Unit 2- Linear and Exponential Relationships:** In earlier grades, students define, evaluate, and compare functions, and use them to model relationships between quantities. In this unit, students will learn function notation and develop the concepts of domain and range. They explore many examples of functions, including sequences; they interpret functions given graphically, numerically, symbolically, and verbally, translate between representations, and understand the limitations of various representations. Students build on and informally extend their understanding of integer exponents to consider exponential functions. They compare and contrast linear and exponential functions, distinguishing between additive and multiplicative change. Students explore systems of equations and inequalities, and they find and interpret their solutions. They interpret arithmetic sequences as linear functions and geometric sequences as exponential functions.

### **Algebra 1B (Year 2)**

**Unit 3- Descriptive Statistics:** This unit builds upon students' prior experiences with data, providing students with more formal means of assessing how a model fits data. Students use regression techniques to describe and approximate linear relationships between quantities. They use graphical representations and knowledge of the context to make judgments about the appropriateness of linear models. With linear models, they look at residuals to analyze the goodness of fit.

**Unit 4- Expressions and Equations:** In this unit, students build on their knowledge from unit 2, where they extended the laws of exponents to rational exponents. Students apply this new understanding of number and strengthen their ability to see structure in and create quadratic and exponential expressions. They create and solve equations, inequalities, and systems of equations involving quadratic expressions.

**Unit 5- Quadratic Functions and Modeling:** In this unit, students consider quadratic functions, comparing the key characteristics of quadratic functions to those of linear and exponential functions. They select from among these functions to model phenomena. Students learn to anticipate the graph of a quadratic function by interpreting various forms of quadratic expressions. In particular, they identify the real solutions of a quadratic equation as the zeros of a related quadratic function. Students expand their experience with functions to include more specialized functions—absolute value, step, and those that are piecewise-defined.

### **English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will

interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

## VERSION REQUIREMENTS

### Fluency Recommendations

**A/G-** Algebra I students become fluent in solving characteristic problems involving the analytic geometry of lines, such as writing down the equation of a line given a point and a slope. Such fluency can support them in solving less routine mathematical problems involving linearity, as well as in modeling linear phenomena (including modeling using systems of linear inequalities in two variables).

**A-APR.1-** Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in Algebra, as well as in their symbolic work with functions. Manipulation can be more mindful when it is fluent.

**A-SSE.1b-** Fluency in transforming expressions and chunking (seeing parts of an expression as a single object) is essential in factoring, completing the square, and other mindful algebraic calculations.

## COURSE STANDARDS

| Name                               | Description  |
|------------------------------------|--|
| <a href="#">MAFS.912.N-RN.1.1:</a> | <p>Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. <i>For example, we define <math>5^{1/3}</math> to be the cube root of 5 because we want <math>(5^{1/3})^3 = 5^{(1/3)3}</math> to hold, so <math>(5^{1/3})^3</math> must equal 5.</i></p> |
| <a href="#">MAFS.912.N-RN.1.2:</a> | <p>Rewrite expressions involving radicals and rational exponents using the properties of exponents.</p>  |
| <a href="#">MAFS.912.N-Q.1.1:</a>  | <p>Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units</p>  |

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|                                     | consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. ★  |
| <a href="#">MAFS.912.N-Q.1.2:</a>   | <p>Define appropriate quantities for the purpose of descriptive modeling. ★</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b></p> <p><b>Algebra 1 Content Notes:</b></p> <p>Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions.</p> </div>  |
| <a href="#">MAFS.912.N-Q.1.3:</a>   | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. ★   |
| <a href="#">MAFS.912.A-SSE.1.1:</a> | <p>Interpret expressions that represent a quantity in terms of its context. ★</p> <ol style="list-style-type: none"> <li>a. Interpret parts of an expression, such as terms, factors, and coefficients.</li> <li>b. Interpret complicated expressions by viewing one or more of their parts as a single entity. <i>For example,</i></li> </ol> <p style="padding-left: 40px;"><i>interpret <math>P(1+r)^n</math> as the product of <math>P</math> and a factor not depending on <math>P</math>.</i></p> |
| <a href="#">MAFS.912.A-CED.1.1:</a> | Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational, absolute, and exponential functions. ★  |
| <a href="#">MAFS.912.A-CED.1.2:</a> | Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. ★   |
| <a href="#">MAFS.912.A-CED.1.3:</a> | Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. <i>For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.</i> ★  |
| <a href="#">MAFS.912.A-CED.1.4:</a> | Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. <i>For example, rearrange Ohm's law <math>V = IR</math> to highlight resistance <math>R</math>.</i> ★   |
| <a href="#">MAFS.912.A-REI.1.1:</a> | Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution.   |

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|                                      | Construct a viable argument to justify a solution method.   |
| <a href="#">MAFS.912.A-REL.2.3:</a>  | Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.  |
| <a href="#">MAFS.912.A-REL.3.5:</a>  | Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.   |
| <a href="#">MAFS.912.A-REL.3.6:</a>  | Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.  |
| <a href="#">MAFS.912.A-REL.4.10:</a> | Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).   |
| <a href="#">MAFS.912.A-REL.4.11:</a> | Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$ ; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. ★ |
| <a href="#">MAFS.912.A-REL.4.12:</a> | Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.   |
| <a href="#">MAFS.912.F-IF.1.1:</a>   | Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If $f$ is a function and $x$ is an element of its domain, then $f(x)$ denotes the output of $f$ corresponding to the input $x$ . The graph of $f$ is the graph of the equation $y = f(x)$ .   |
| <a href="#">MAFS.912.F-IF.1.2:</a>   | Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.   |
| <a href="#">MAFS.912.F-IF.1.3:</a>   | Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by $f(0) = f(1) = 1$ , $f(n+1) = f(n) + f(n-1)$ for $n \geq 1$ .  |
| <a href="#">MAFS.912.F-IF.2.4:</a>   | For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal   |

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|                                    | description of the relationship. <i>Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</i> ★   |
| <a href="#">MAFS.912.F-IF.2.5:</a> | Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. <i>For example, if the function <math>h(n)</math> gives the number of person-hours it takes to assemble engines in a factory, then the positive integers would be an appropriate domain for the function.</i> ★  |
| <a href="#">MAFS.912.F-IF.2.6:</a> | Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. ★  |
| <a href="#">MAFS.912.F-IF.3.7:</a> | Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★ <ul style="list-style-type: none"> <li>a. Graph linear and quadratic functions and show intercepts, maxima, and minima.</li> <li>b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.</li> <li>c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.</li> <li>d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.</li> <li>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.</li> </ul> |
| <a href="#">MAFS.912.F-IF.3.9:</a> | Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). <i>For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.</i>  |
| <a href="#">MAFS.912.F-BF.1.1:</a> | Write a function that describes a relationship between two quantities. ★ <ul style="list-style-type: none"> <li>a. Determine an explicit expression, a recursive process, or steps for calculation from a context.</li> <li>b. Combine standard function types using arithmetic</li> </ul>  |



|   |  |
|---|--|
|   | <p>operations. <i>For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.</i></p> <p>c. Compose functions. <i>For example, if <math>T(y)</math> is the temperature in the atmosphere as a function of height, and <math>h(t)</math> is the height of a weather balloon as a function of time, then <math>T(h(t))</math> is the temperature at the location of the weather balloon as a function of time.</i></p>         |
| <p><a href="#">MAFS.912.F-BF.2.3:</a></p> | <p>Identify the effect on the graph of replacing <math>f(x)</math> by <math>f(x) + k</math>, <math>kf(x)</math>, <math>f(kx)</math>, and <math>f(x + k)</math> for specific values of <math>k</math> (both positive and negative); find the value of <math>k</math> given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. <i>Include recognizing even and odd functions from their graphs and algebraic expressions for them.</i></p>  |
| <p><a href="#">MAFS.912.F-LE.1.1:</a></p> | <p>Distinguish between situations that can be modeled with linear functions and with exponential functions. ★</p> <p>a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.</p> <p>b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.</p> <p>c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.</p> |
| <p><a href="#">MAFS.912.F-LE.1.2:</a></p> | <p>Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). ★</p>   |
| <p><a href="#">MAFS.912.F-LE.1.3:</a></p> | <p>Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. ★</p>  |
| <p><a href="#">MAFS.912.F-LE.2.5:</a></p> | <p>Interpret the parameters in a linear or exponential function in terms of a context. ★</p>   |
| <p><a href="#">LAFS.910.SL.1.1:</a></p>   | <p>Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.</p> <p>a. Come to discussions prepared, having read and researched</p>   |

|                                    |  |
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|                                    | <p>material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.</p> <p>b. Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed.</p> <p>c. Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.</p> <p>d. Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.</p> |
| <a href="#">LAFS.910.SL.1.2:</a>   | Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.   |
| <a href="#">LAFS.910.SL.1.3:</a>   | Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.  |
| <a href="#">LAFS.910.SL.2.4:</a>   | Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.  |
| <a href="#">LAFS.910.RST.1.3:</a>  | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.  |
| <a href="#">LAFS.910.RST.2.4:</a>  | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.  |
| <a href="#">LAFS.910.RST.3.7:</a>  | Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.   |
|                                    | Write arguments focused on <i>discipline-specific content</i> .  |
| <a href="#">LAFS.910.WHST.1.1:</a> | <p>a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.</p>  |

- b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience’s knowledge level and concerns.
- c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.
- d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
- e. Provide a concluding statement or section that follows from or supports the argument presented.

[LAFS.910.WHST.2.4:](#) Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

[LAFS.910.WHST.3.9:](#) Draw evidence from informational texts to support analysis, reflection, and research.

**Make sense of problems and persevere in solving them.**

[MAFS.K12.MP.1.1:](#) Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

**Reason abstractly and quantitatively.**

[MAFS.K12.MP.2.1:](#)

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

**Construct viable arguments and critique the reasoning of others.**

[MAFS.K12.MP.3.1:](#)

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

**Model with mathematics.**

[MAFS.K12.MP.4.1:](#)

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a

student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another.

Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

**Use appropriate tools strategically.**

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

[MAFS.K12.MP.5.1:](#)

**Attend to precision.**

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently,

[MAFS.K12.MP.6.1:](#)

express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

**Look for and make use of structure.**

[MAFS.K12.MP.7.1:](#)

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

**Look for and express regularity in repeated reasoning.**

[MAFS.K12.MP.8.1:](#)

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.AC.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.



## **Algebra 1-B for Credit Recovery (#1200385)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 1200385

**Abbreviated Title:** ALG 1-B CR

**Number of Credits:** One credit (1)

**Course Type:** Elective

**Course Level:** 2

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 9,10,11,12

### **VERSION DESCRIPTION**

Special Notes: Credit Recovery courses are credit bearing courses with specific content requirements defined by Next Generation Sunshine State Standards and/or Florida Standards. Students enrolled in a Credit Recovery course must have previously attempted the corresponding course (and/or End-of-Course assessment) since the course requirements for the Credit Recovery course is exactly the same as the previously attempted corresponding course. For example, Geometry (1206310) and Geometry for Credit Recovery (1206315) have identical content requirements. It is important to note that Credit Recovery courses are not bound by Section 1003.436(1)(a), Florida Statutes, requiring a minimum of 135 hours of bona fide instruction (120 hours in a school/district implementing block scheduling) in a designed course of study that contains student performance standards, since the students have previously attempted successful completion of the corresponding course. Additionally, Credit Recovery courses should ONLY be used for credit recovery, grade forgiveness, or remediation for students needing to prepare for an End-of-Course assessment retake.

### **GENERAL NOTES**

The fundamental purpose of this course is to formalize and extend the mathematics that students learned in the middle grades. The critical areas, called units, deepen and extend understanding of linear and exponential relationships by contrasting them with each other and by applying linear models to data that exhibit a linear trend, and students engage in methods for analyzing, solving, and using quadratic functions. The Standards for Mathematical Practice apply throughout each course and, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations.

### **Algebra 1A (Year 1)**

**Unit 1- Relationships Between Questions and Reasoning with Equations:** By the end of eighth grade, students have learned to solve linear equations in one variable and have



applied graphical and algebraic methods to analyze and solve systems of linear equations in two variables. Now, students analyze and explain the process of solving an equation. Students develop fluency writing, interpreting, and translating between various forms of linear equations and inequalities, and using them to solve problems. They master the solution of linear equations and apply related solution techniques and the laws of exponents to the creation and solution of simple exponential equations.

**Unit 2- Linear and Exponential Relationships:** In earlier grades, students define, evaluate, and compare functions, and use them to model relationships between quantities. In this unit, students will learn function notation and develop the concepts of domain and range. They explore many examples of functions, including sequences; they interpret functions given graphically, numerically, symbolically, and verbally, translate between representations, and understand the limitations of various representations. Students build on and informally extend their understanding of integer exponents to consider exponential functions. They compare and contrast linear and exponential functions, distinguishing between additive and multiplicative change. Students explore systems of equations and inequalities, and they find and interpret their solutions. They interpret arithmetic sequences as linear functions and geometric sequences as exponential functions.

## **Algebra 1B (Year 2)**

**Unit 3- Descriptive Statistics:** This unit builds upon students prior experiences with data, providing students with more formal means of assessing how a model fits data. Students use regression techniques to describe and approximate linear relationships between quantities. They use graphical representations and knowledge of the context to make judgments about the appropriateness of linear models. With linear models, they look at residuals to analyze the goodness of fit.

**Unit 4- Expressions and Equations:** In this unit, students build on their knowledge from unit 2, where they extended the laws of exponents to rational exponents. Students apply this new understanding of number and strengthen their ability to see structure in and create quadratic and exponential expressions. They create and solve equations, inequalities, and systems of equations involving quadratic expressions.

**Unit 5- Quadratic Functions and Modeling:** In this unit, students consider quadratic functions, comparing the key characteristics of quadratic functions to those of linear and

exponential functions. They select from among these functions to model phenomena. Students learn to anticipate the graph of a quadratic function by interpreting various forms of quadratic expressions. In particular, they identify the real solutions of a quadratic equation as the zeros of a related quadratic function. Students expand their experience with functions to include more specialized functions absolute value, step, and those that are piece wise-defined.

### **English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

## **VERSION REQUIREMENTS**

### **Fluency Recommendations**

**A/G-** Algebra I students become fluent in solving characteristic problems involving the analytic geometry of lines, such as writing down the equation of a line given a point and a slope. Such fluency can support them in solving less routine mathematical problems involving linearity, as well as in modeling linear phenomena (including modeling using systems of linear inequalities in two variables).

**A-APR.1-** Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in Algebra, as well as in their symbolic work with functions. Manipulation can be more mindful when it is fluent.

**A-SSE.1b-** Fluency in transforming expressions and chunking (seeing parts of an expression as a single object) is essential in factoring, completing the square, and other mindful algebraic calculations.

## **COURSE STANDARDS**

| Name                                | Description  |
|-------------------------------------|--|
| <a href="#">MAFS.912.N-RN.2.3:</a>  | Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.  |
| <a href="#">MAFS.912.A-SSE.1.1:</a> | <p>Interpret expressions that represent a quantity in terms of its context. ★</p> <p>a. Interpret parts of an expression, such as terms, factors, and coefficients.</p> <p>b. Interpret complicated expressions by viewing one or more of their parts as a single entity. <i>For example,</i></p> <p>interpret <math>P(1+r)^n</math> as the product of <math>P</math> and a factor not depending on <math>P</math>.</p>  |
| <a href="#">MAFS.912.A-SSE.1.2:</a> | Use the structure of an expression to identify ways to rewrite it. <i>For example, see <math>x^4 - y^4</math> as <math>(x^2)^2 - (y^2)^2</math>, thus recognizing it as a difference of squares that can be factored as <math>(x^2 - y^2)(x^2 + y^2)</math>.</i>   |
| <a href="#">MAFS.912.A-SSE.2.3:</a> | <p>Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. ★</p> <p>a. Factor a quadratic expression to reveal the zeros of the function it defines.</p> <p>b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.</p> <p>c. Use the properties of exponents to transform expressions for exponential functions. <i>For example the</i></p> <p>expression <math>1.15^t</math> can be rewritten as <math>(1.15^{1/12})^{12t} \approx 1.012^{12t}</math> to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.</p> |
| <a href="#">MAFS.912.A-APR.1.1:</a> | <p>Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>Remarks/Examples:</b><br/> <b>Algebra 1 - Fluency Recommendations</b></p> <p>Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in algebra, as well as</p> </div>  |

|                                     |   |
|-------------------------------------|---|
|                                     | <p>in their symbolic work with functions. Manipulation can be more mindful when it is fluent.</p>   |
| <a href="#">MAFS.912.A-APR.2.3:</a> | Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.   |
| <a href="#">MAFS.912.A-CED.1.1:</a> | Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational, absolute, and exponential functions. ★  |
| <a href="#">MAFS.912.A-CED.1.2:</a> | Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. ★   |
| <a href="#">MAFS.912.A-CED.1.4:</a> | Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. <i>For example, rearrange Ohm's law <math>V = IR</math> to highlight resistance <math>R</math>.</i> ★   |
| <a href="#">MAFS.912.A-REL.2.4:</a> | <p>Solve quadratic equations in one variable.</p> <ol style="list-style-type: none"> <li>Use the method of completing the square to transform any quadratic equation in <math>x</math> into an equation of the form <math>(x - p)^2 = q</math> that has the same solutions. Derive the quadratic formula from this form.</li> <li>Solve quadratic equations by inspection (e.g., for <math>x^2 = 49</math>), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as <math>a \pm bi</math> for real numbers <math>a</math> and <math>b</math>.</li> </ol> |
| <a href="#">MAFS.912.F-IF.2.4:</a>  | For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. <i>Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</i> ★   |
| <a href="#">MAFS.912.F-IF.2.5:</a>  | Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. <i>For example, if the function <math>h(n)</math> gives the number of person-hours it takes to assemble engines in a factory, then the positive integers would be an appropriate domain for the function.</i> ★  |
| <a href="#">MAFS.912.F-IF.2.6:</a>  | Calculate and interpret the average rate of change of a function  |

(presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. ★

Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★

[MAFS.912.F-IF.3.7:](#)

- a. Graph linear and quadratic functions and show intercepts, maxima, and minima.
- b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
- c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.
- d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.
- e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.

Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

[MAFS.912.F-IF.3.8:](#)

- a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
- b. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as  $y = (1.02)^t$ ,  $y = (0.97)^t$ ,  $y = (1.01)^{2t}$ ,  $y = (1.2)^{t/10}$ , and classify them as representing exponential growth or decay.*

[MAFS.912.F-IF.3.9:](#)

Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*

[MAFS.912.F-BF.1.1:](#)

Write a function that describes a relationship between two

quantities. ★

- a. Determine an explicit expression, a recursive process, or steps for calculation from a context.
- b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*
- c. Compose functions. *For example, if  $T(y)$  is the temperature in the atmosphere as a function of height, and  $h(t)$  is the height of a weather balloon as a function of time, then  $T(h(t))$  is the temperature at the location of the weather balloon as a function of time.*

[MAFS.912.F-BF.2.3:](#)

Identify the effect on the graph of replacing  $f(x)$  by  $f(x) + k$ ,  $kf(x)$ ,  $f(kx)$ , and  $f(x + k)$  for specific values of  $k$  (both positive and negative); find the value of  $k$  given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.*

[MAFS.912.F-LE.1.3:](#)

Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. ★

[MAFS.912.S-ID.1.1:](#)

Represent data with plots on the real number line (dot plots, histograms, and box plots). ★

**Remarks/Examples:**

In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.

[MAFS.912.S-ID.1.2:](#)

Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. ★

**Remarks/Examples:**

In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.

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|---|--|
| <p><a href="#">MAFS.912.S-ID.1.3:</a></p> | <p>Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). ★</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>           In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.</p> </div>   |
| <p><a href="#">MAFS.912.S-ID.1.4:</a></p> | <p>Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. ★</p>  |
| <p><a href="#">MAFS.912.S-ID.2.5:</a></p> | <p>Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. ★</p>   |
| <p><a href="#">MAFS.912.S-ID.2.6:</a></p> | <p>Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. ★</p> <ol style="list-style-type: none"> <li>a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. <i>Use given functions or choose a function suggested by the context. Emphasize linear, and exponential models.</i></li> <li>b. Informally assess the fit of a function by plotting and analyzing residuals.</li> <li>c. Fit a linear function for a scatter plot that suggests a linear association.</li> </ol> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>Remarks/Examples:</b><br/>           Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals.</p> </div> |
| <p><a href="#">MAFS.912.S-ID.3.7:</a></p> | <p>Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. ★</p>  |
| <p><a href="#">MAFS.912.S-ID.3.8:</a></p> | <p>Compute (using technology) and interpret the correlation coefficient of a linear fit. ★</p>   |

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| <a href="#">MAFS.912.S-ID.3.9:</a> | Distinguish between correlation and causation. ★  |
| <a href="#">LAFS.910.SL.1.1:</a>   | <p>Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.</p> <ol style="list-style-type: none"> <li>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.</li> <li>b. Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed.</li> <li>c. Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.</li> <li>d. Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.</li> </ol> |
| <a href="#">LAFS.910.SL.1.2:</a>   | Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.  |
| <a href="#">LAFS.910.SL.1.3:</a>   | Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.   |
| <a href="#">LAFS.910.SL.2.4:</a>   | Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.   |
| <a href="#">LAFS.910.RST.2.4:</a>  | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.   |
| <a href="#">LAFS.910.RST.3.7:</a>  | Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.  |
| <a href="#">LAFS.910.WHST.1.1:</a> | Write arguments focused on <i>discipline-specific content</i> .   |



- a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.
- b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience's knowledge level and concerns.
- c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.
- d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
- e. Provide a concluding statement or section that follows from or supports the argument presented.

[LAFS.910.WHST.2.4:](#)

Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

[LAFS.910.WHST.3.9:](#)

Draw evidence from informational texts to support analysis, reflection, and research.

[MAFS.K12.MP.1.1:](#)

**Make sense of problems and persevere in solving them.**

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need.

Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers

to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

**Reason abstractly and quantitatively.**

[MAFS.K12.MP.2.1:](#)

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

**Construct viable arguments and critique the reasoning of others.**

[MAFS.K12.MP.3.1:](#)

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

### **Model with mathematics.**

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another.

#### [MAFS.K12.MP.4.1:](#)

Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

### **Use appropriate tools strategically.**

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

#### [MAFS.K12.MP.5.1:](#)

### **Attend to precision.**

#### [MAFS.K12.MP.6.1:](#)

Mathematically proficient students try to communicate precisely

to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

**Look for and make use of structure.**

[MAFS.K12.MP.7.1:](#)

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

**Look for and express regularity in repeated reasoning.**

[MAFS.K12.MP.8.1:](#)

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.AC.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.

## **Geometry for Credit Recovery (#1206315)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 1206315

**Abbreviated Title:** GEO CR

**Number of Credits:** One credit (1)

**Course Length:** Year (Y)

**Course Type:** Elective

**Course Level:** 2

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 9,10,11,12

### **VERSION DESCRIPTION**

Special notes: Credit Recovery courses are credit bearing courses with specific content requirements defined by Next Generation Sunshine State Standards and/or Florida Standards. Students enrolled in a Credit Recovery course must have previously attempted the corresponding course (and/or End-of-Course assessment) since the course requirements for the Credit Recovery course are exactly the same as the previously attempted corresponding course. For example, Geometry (1206310) and Geometry for Credit Recovery (1206315) have identical content requirements. It is important to note that Credit Recovery courses are not bound by Section 1003.436(1)(a), Florida Statutes, requiring a minimum of 135 hours of bona fide instruction (120 hours in a school/district implementing block scheduling) in a designed course of study that contains student performance standards, since the students have previously attempted successful completion of the corresponding course. Additionally, Credit Recovery courses should ONLY be used for credit recovery, grade forgiveness, or remediation for students needing to prepare for an End-of-Course assessment retake.

### **GENERAL NOTES**

The fundamental purpose of the course in Geometry is to formalize and extend students' geometric experiences from the middle grades. Students explore more complex geometric situations and deepen their explanations of geometric relationships, moving towards formal mathematical arguments. Important differences exist between this Geometry course and the historical approach taken in Geometry classes. For example, transformations are emphasized early in this course. Close attention should be paid to the introductory content for the Geometry conceptual category found in the high school CCSS. The Standards for Mathematical Practice apply throughout each course and, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations. The critical areas, organized into five units are as follows.

**Unit 1- Congruence, Proof, and Constructions:** In previous grades, students were asked to draw triangles based on given measurements. They also have prior experience

with rigid motions: translations, reflections, and rotations and have used these to develop notions about what it means for two objects to be congruent. In this unit, students establish triangle congruence criteria, based on analyses of rigid motions and formal constructions. They use triangle congruence as a familiar foundation for the development of formal proof. Students prove theorems—using a variety of formats—and solve problems about triangles, quadrilaterals, and other polygons. They apply reasoning to complete geometric constructions and explain why they work.

**Unit 2- Similarity, Proof, and Trigonometry:** Students apply their earlier experience with dilations and proportional reasoning to build a formal understanding of similarity. They identify criteria for similarity of triangles, use similarity to solve problems, and apply similarity in right triangles to understand right triangle trigonometry, with particular attention to special right triangles and the Pythagorean theorem. Students develop the Laws of Sines and Cosines in order to find missing measures of general (not necessarily right) triangles, building on students' work with quadratic equations done in the first course. They are able to distinguish whether three given measures (angles or sides) define 0, 1, 2, or infinitely many triangles.

**Unit 3- Extending to Three Dimensions:** Students' experience with two-dimensional and three-dimensional objects is extended to include informal explanations of circumference, area and volume formulas. Additionally, students apply their knowledge of two-dimensional shapes to consider the shapes of cross-sections and the result of rotating a two-dimensional object about a line.

**Unit 4- Connecting Algebra and Geometry Through Coordinates:** Building on their work with the Pythagorean theorem in 8th grade to find distances, students use a rectangular coordinate system to verify geometric relationships, including properties of special triangles and quadrilaterals and slopes of parallel and perpendicular lines, which relates back to work done in the first course. Students continue their study of quadratics by connecting the geometric and algebraic definitions of the parabola.

**Unit 5- Circles With and Without Coordinates:** In this unit students prove basic theorems about circles, such as a tangent line is perpendicular to a radius, inscribed angle theorem, and theorems about chords, secants, and tangents dealing with segment lengths and angle measures. They study relationships among segments on chords, secants, and tangents as an application of similarity. In the Cartesian coordinate system, students use the distance formula to write the equation of a circle when given the radius and the coordinates of its center. Given an equation of a circle, they draw the graph in the coordinate plane, and apply techniques for solving quadratic equations, which relates

back to work done in the first course, to determine intersections between lines and circles or parabolas and between two circles.

**English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL’s need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

**COURSE STANDARDS**

| Name                               | Description  |
|------------------------------------|--|
| <a href="#">MAFS.912.G-CO.1.1:</a> | Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.  |
| <a href="#">MAFS.912.G-CO.1.2:</a> | Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch). |
| <a href="#">MAFS.912.G-CO.1.3:</a> | Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.   |
| <a href="#">MAFS.912.G-CO.1.4:</a> | Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.   |
| <a href="#">MAFS.912.G-CO.1.5:</a> | Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.   |
| <a href="#">MAFS.912.G-CO.2.6:</a> | Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.   |



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| <a href="#">MAFS.912.G-CO.2.7:</a>  | Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.  |
| <a href="#">MAFS.912.G-CO.2.8:</a>  | Explain how the criteria for triangle congruence (ASA, SAS, SSS, and Hypotenuse-Leg) follow from the definition of congruence in terms of rigid motions.  |
| <a href="#">MAFS.912.G-CO.3.9:</a>  | Prove theorems about lines and angles; use theorems about lines and angles to solve problems. <i>Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.</i>   |
| <a href="#">MAFS.912.G-CO.3.10:</a> | Prove theorems about triangles; use theorems about triangles to solve problems. <i>Theorems include: measures of interior angles of a triangle sum to <math>180^\circ</math>; triangle inequality theorem; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.</i>                           |
| <a href="#">MAFS.912.G-CO.3.11:</a> | Prove theorems about parallelograms; use theorems about parallelograms to solve problems. <i>Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.</i>   |
| <a href="#">MAFS.912.G-CO.4.12:</a> | Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). <i>Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.</i> |
|                                     | <div style="border: 1px solid black; padding: 10px;"> <p><b>Remarks/Examples:</b><br/> <b>Geometry - Fluency Recommendations</b></p> <p>Fluency with the use of construction tools, physical and computational, helps students draft a model of a geometric phenomenon and can lead to conjectures and proofs.</p> </div>   |
| <a href="#">MAFS.912.G-CO.4.13:</a> | Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.   |
| <a href="#">MAFS.912.G-SRT.1.1:</a> | Verify experimentally the properties of dilations given by a center and a scale factor:   |

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|                                     | <p>a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.</p> <p>b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.</p>   |
| <a href="#">MAFS.912.G-SRT.1.2:</a> | <p>Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.</p>  |
| <a href="#">MAFS.912.G-SRT.1.3:</a> | <p>Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.</p>   |
| <a href="#">MAFS.912.G-SRT.2.4:</a> | <p>Prove theorems about triangles. <i>Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.</i></p>  |
| <a href="#">MAFS.912.G-SRT.2.5:</a> | <p>Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.</p> <div style="border: 1px solid black; padding: 10px; margin-top: 10px;"> <p><b>Remarks/Examples:</b><br/> <b>Geometry - Fluency Recommendations</b></p> <p>Fluency with the triangle congruence and similarity criteria will help students throughout their investigations of triangles, quadrilaterals, circles, parallelism, and trigonometric ratios. These criteria are necessary tools in many geometric modeling tasks.</p> </div> |
| <a href="#">MAFS.912.G-SRT.3.6:</a> | <p>Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.</p>  |
| <a href="#">MAFS.912.G-SRT.3.7:</a> | <p>Explain and use the relationship between the sine and cosine of complementary angles.</p>   |
| <a href="#">MAFS.912.G-SRT.3.8:</a> | <p>Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. ★</p>  |
| <a href="#">MAFS.912.G-C.1.1:</a>   | <p>Prove that all circles are similar.</p>   |
| <a href="#">MAFS.912.G-C.1.2:</a>   | <p>Identify and describe relationships among inscribed angles, radii, and chords. <i>Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.</i></p>  |

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| <a href="#">MAFS.912.G-C.1.3:</a>   | Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.   |
| <a href="#">MAFS.912.G-C.2.5:</a>   | Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.   |
| <a href="#">MAFS.912.G-GPE.1.1:</a> | Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.  |
| <a href="#">MAFS.912.G-GPE.2.4:</a> | <p>Use coordinates to prove simple geometric theorems algebraically. <i>For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point <math>(1, \sqrt{3})</math> lies on the circle centered at the origin and containing the point <math>(0, 2)</math>.</i></p> <div style="border: 1px solid black; padding: 10px;"> <p><b>Remarks/Examples:</b><br/> <b>Geometry - Fluency Recommendations</b></p> <p>Fluency with the use of coordinates to establish geometric results, calculate length and angle, and use geometric representations as a modeling tool are some of the most valuable tools in mathematics and related fields.</p> </div> |
| <a href="#">MAFS.912.G-GPE.2.5:</a> | <p>Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).</p> <div style="border: 1px solid black; padding: 10px;"> <p><b>Remarks/Examples:</b><br/> <b>Geometry - Fluency Recommendations</b></p> <p>Fluency with the use of coordinates to establish geometric results, calculate length and angle, and use geometric representations as a modeling tool are some of the most valuable tools in mathematics and related fields.</p> </div>   |
| <a href="#">MAFS.912.G-GPE.2.6:</a> | Find the point on a directed line segment between two given points that partitions the segment in a given ratio.   |
| <a href="#">MAFS.912.G-GPE.2.7:</a> | <p>Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula. ★</p> <div style="border: 1px solid black; padding: 10px;"> <p><b>Remarks/Examples:</b><br/> <b>Geometry - Fluency Recommendations</b></p> </div>   |

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|  | <p>Fluency with the use of coordinates to establish geometric results, calculate length and angle, and use geometric representations as a modeling tool are some of the most valuable tools in mathematics and related fields.</p>   |
| <p><a href="#">MAFS.912.G-GMD.1.1:</a></p> | <p>Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. <i>Use dissection arguments, Cavalieri's principle, and informal limit arguments.</i></p>  |
| <p><a href="#">MAFS.912.G-GMD.1.3:</a></p> | <p>Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. ★</p>  |
| <p><a href="#">MAFS.912.G-GMD.2.4:</a></p> | <p>Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.</p>   |
| <p><a href="#">MAFS.912.G-MG.1.1:</a></p>  | <p>Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). ★</p>  |
| <p><a href="#">MAFS.912.G-MG.1.2:</a></p>  | <p>Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). ★</p>   |
| <p><a href="#">MAFS.912.G-MG.1.3:</a></p>  | <p>Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios). ★</p>  |
| <p><a href="#">LAFS.910.SL.1.1:</a></p>    | <p>Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.</p> <ol style="list-style-type: none"> <li>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.</li> <li>b. Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed.</li> <li>c. Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.</li> <li>d. Respond thoughtfully to diverse perspectives, summarize</li> </ol> |

points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.

[LAFS.910.SL.1.2:](#)

Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.

[LAFS.910.SL.1.3:](#)

Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.

[LAFS.910.SL.2.4:](#)

Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

[LAFS.910.RST.1.3:](#)

Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

[LAFS.910.RST.2.4:](#)

Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.

[LAFS.910.RST.3.7:](#)

Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

[LAFS.910.WHST.1.1:](#)

Write arguments focused on *discipline-specific content*.

- a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.
- b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience's knowledge level and concerns.
- c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.
- d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
- e. Provide a concluding statement or section that follows

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|                                    | from or supports the argument presented.   |
| <a href="#">LAFS.910.WHST.2.4:</a> | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.   |
| <a href="#">LAFS.910.WHST.3.9:</a> | Draw evidence from informational texts to support analysis, reflection, and research.  |
|                                    | <p><b>Make sense of problems and persevere in solving them.</b></p> <p>Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need.</p> <p>Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.</p> |
| <a href="#">MAFS.K12.MP.1.1:</a>   |  |
|                                    | <p><b>Reason abstractly and quantitatively.</b></p> <p>Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of</p>  |
| <a href="#">MAFS.K12.MP.2.1:</a>   |  |

quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

**Construct viable arguments and critique the reasoning of others.**

[MAFS.K12.MP.3.1:](#)

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

**Model with mathematics.**

[MAFS.K12.MP.4.1:](#)

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its

purpose.

**Use appropriate tools strategically.**

[MAFS.K12.MP.5.1:](#)

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

**Attend to precision.**

[MAFS.K12.MP.6.1:](#)

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

**Look for and make use of structure.**

[MAFS.K12.MP.7.1:](#)

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning



about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

**Look for and express regularity in repeated reasoning.**

[MAFS.K12.MP.8.1:](#)

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.AC.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.

# Liberal Arts Mathematics 1 (#1207300)

**Version for Academic Year:** 2015 - 2016

**Course Number:** 1207300

**Abbreviated Title:** LIB ARTS MATH 1

**Number of Credits:** One credit (1)

**Course Length:** Year (Y)

**Course Type:** Core

**Course Level:** 2

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 9,10,11,12

## GENERAL NOTES

### English Language Development ELD Standards Special Notes Section:

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

## COURSE STANDARDS

| Name                              | Description   |
|-----------------------------------|---|
| <a href="#">MAFS.912.N-Q.1.1:</a> | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. ★ |
| <a href="#">MAFS.912.N-Q.1.2:</a> | Define appropriate quantities for the purpose of descriptive modeling. ★  |
|                                   | <b>Remarks/Examples:</b>  |

**Algebra 1 Content Notes:**

Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions.

[MAFS.912.N-Q.1.3:](#)

Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. ★

[MAFS.912.A-SSE.1.1:](#)

Interpret expressions that represent a quantity in terms of its context. ★

- a. Interpret parts of an expression, such as terms, factors, and coefficients.
- b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example,*

*interpret  $P(1+r)^n$  as the product of  $P$  and a factor not depending on  $P$ .*

[MAFS.912.A-APR.1.1:](#)

Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.

**Remarks/Examples:  
Algebra 1 - Fluency Recommendations**

Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in algebra, as well as in their symbolic work with functions. Manipulation can be more mindful when it is fluent.

[MAFS.912.A-CED.1.1:](#)

Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational, absolute, and exponential functions. ★

[MAFS.912.A-CED.1.2:](#)

Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. ★

[MAFS.912.A-CED.1.3:](#)

Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints*

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|                                      | <i>on combinations of different foods.</i> ★  |
| <a href="#">MAFS.912.A-CED.1.4:</a>  | Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. <i>For example, rearrange Ohm's law <math>V = IR</math> to highlight resistance <math>R</math>.</i> ★   |
| <a href="#">MAFS.912.A-REI.1.1:</a>  | Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.   |
| <a href="#">MAFS.912.A-REI.1.2:</a>  | Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.  |
| <a href="#">MAFS.912.A-REI.2.3:</a>  | Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.  |
| <a href="#">MAFS.912.A-REI.3.5:</a>  | Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.   |
| <a href="#">MAFS.912.A-REI.3.6:</a>  | Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.  |
| <a href="#">MAFS.912.A-REI.4.10:</a> | Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).   |
| <a href="#">MAFS.912.A-REI.4.11:</a> | Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$ ; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. ★ |
| <a href="#">MAFS.912.A-REI.4.12:</a> | Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.   |
| <a href="#">MAFS.912.F-IF.1.1:</a>   | Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If $f$ is a function and $x$ is an element of its domain, then $f(x)$ denotes the output of $f$ corresponding to the input $x$ . The graph of $f$ is the graph of the equation $y = f(x)$ .   |
| <a href="#">MAFS.912.F-IF.1.2:</a>   | Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in   |

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|                                     | terms of a context.   |
| <a href="#">MAFS.912.F-IF.2.4:</a>  | For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. <i>Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</i> ★             |
| <a href="#">MAFS.912.F-IF.2.5:</a>  | Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. <i>For example, if the function <math>h(n)</math> gives the number of person-hours it takes to assemble engines in a factory, then the positive integers would be an appropriate domain for the function.</i> ★  |
| <a href="#">MAFS.912.F-IF.2.6:</a>  | Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. ★  |
| <a href="#">MAFS.912.G-CO.1.1:</a>  | Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.   |
| <a href="#">MAFS.912.G-CO.1.3:</a>  | Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.  |
| <a href="#">MAFS.912.G-CO.1.4:</a>  | Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.  |
| <a href="#">MAFS.912.G-CO.4.12:</a> | Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). <i>Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.</i> |
|                                     | <div style="border: 1px solid black; padding: 10px;"> <p><b>Remarks/Examples:</b><br/> <b>Geometry - Fluency Recommendations</b></p> <p>Fluency with the use of construction tools, physical and computational, helps students draft a model of a geometric phenomenon and can lead to conjectures and proofs.</p> </div>   |
| <a href="#">MAFS.912.G-CO.4.13:</a> | Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.   |
| <a href="#">MAFS.912.G-</a>         | Given two figures, use the definition of similarity in terms of   |

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| <a href="#">SRT.1.2:</a>            | similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.  |
| <a href="#">MAFS.912.G-SRT.1.3:</a> | Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.   |
| <a href="#">MAFS.912.G-SRT.2.4:</a> | Prove theorems about triangles. <i>Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.</i>  |
|                                     | Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.   |
| <a href="#">MAFS.912.G-SRT.2.5:</a> | <div style="border: 1px solid black; padding: 10px;"> <p><b>Remarks/Examples:</b><br/> <b>Geometry - Fluency Recommendations</b></p> <p>Fluency with the triangle congruence and similarity criteria will help students throughout their investigations of triangles, quadrilaterals, circles, parallelism, and trigonometric ratios. These criteria are necessary tools in many geometric modeling tasks.</p> </div> |
| <a href="#">MAFS.912.G-GMD.1.3:</a> | Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. ★  |
| <a href="#">MAFS.912.G-GMD.2.4:</a> | Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.   |
| <a href="#">MAFS.912.G-MG.1.1:</a>  | Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). ★  |
| <a href="#">MAFS.912.G-MG.1.2:</a>  | Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). ★   |
| <a href="#">MAFS.912.G-MG.1.3:</a>  | Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios). ★  |
|                                     | Represent data with plots on the real number line (dot plots, histograms, and box plots). ★   |
| <a href="#">MAFS.912.S-ID.1.1:</a>  | <div style="border: 1px solid black; padding: 10px;"> <p><b>Remarks/Examples:</b></p> <p>In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such</p> </div>   |

as the shape of the distribution or the existence of extreme data points.

[MAFS.912.S-ID.1.2:](#)

Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. ★

**Remarks/Examples:**

In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.

[MAFS.912.S-ID.1.3:](#)

Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). ★

**Remarks/Examples:**

In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.

[MAFS.912.S-ID.1.4:](#)

Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. ★

[LAFS.910.SL.1.1:](#)

Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

- a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.
- b. Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed.
- c. Propel conversations by posing and responding to questions that relate the current discussion to broader

|                                    |   |
|------------------------------------|---|
|                                    | <p>themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.</p> <p>d. Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.</p>   |
| <a href="#">LAFS.910.SL.1.2:</a>   | Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.  |
| <a href="#">LAFS.910.SL.1.3:</a>   | Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.   |
| <a href="#">LAFS.910.SL.2.4:</a>   | Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.   |
| <a href="#">LAFS.910.RST.1.3:</a>  | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.   |
| <a href="#">LAFS.910.RST.2.4:</a>  | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.   |
| <a href="#">LAFS.910.RST.3.7:</a>  | Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.  |
| <a href="#">LAFS.910.WHST.1.1:</a> | <p>Write arguments focused on <i>discipline-specific content</i>.</p> <ol style="list-style-type: none"> <li>a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.</li> <li>b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience’s knowledge level and concerns.</li> <li>c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.</li> <li>d. Establish and maintain a formal style and objective tone</li> </ol> |



|   |   |
|---|---|
|   | <p>while attending to the norms and conventions of the discipline in which they are writing.</p> <p>e. Provide a concluding statement or section that follows from or supports the argument presented.</p>  |
| <p><a href="#">LAFS.910.WHST.2.4:</a></p> | <p>Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.</p>   |
| <p><a href="#">LAFS.910.WHST.3.9:</a></p> | <p>Draw evidence from informational texts to support analysis, reflection, and research.</p>  |
| <p><a href="#">MAFS.K12.MP.1.1:</a></p>   | <p><b>Make sense of problems and persevere in solving them.</b></p> <p>Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.</p> |
| <p><a href="#">MAFS.K12.MP.2.1:</a></p>   | <p><b>Reason abstractly and quantitatively.</b></p> <p>Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the</p>   |

symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

**Construct viable arguments and critique the reasoning of others.**

[MAFS.K12.MP.3.1:](#)

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

**Model with mathematics.**

[MAFS.K12.MP.4.1:](#)

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw

conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

**Use appropriate tools strategically.**

[MAFS.K12.MP.5.1:](#)

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

**Attend to precision.**

[MAFS.K12.MP.6.1:](#)

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

**Look for and make use of structure.**

[MAFS.K12.MP.7.1:](#)

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three

more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

**Look for and express regularity in repeated reasoning.**

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through  $(1, 2)$  with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

[MAFS.K12.MP.8.1:](#)

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.AC.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.

## Analysis of Functions Honors (#1201315)

**Version for Academic Year:** 2015 - 2016

**Course Number:** 1201315

**Abbreviated Title:** ANALYSIS OF FUNC HON

**Number of Credits:** Half credit (.5)

**Course Length:** Semester (S)

**Honors?** Yes

**Course Type:** Core

**Course Level:** 3

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 9,10,11,12

**Graduation Requirement:** Mathematics

### GENERAL NOTES

#### English Language Development ELD Standards Special Notes Section:

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/MA.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

### COURSE STANDARDS

| Name                                | Description  |
|-------------------------------------|--|
| <a href="#">MAFS.912.N-CN.3.9:</a>  | Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.   |
| <a href="#">MAFS.912.A-APR.2.2:</a> | Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number $a$ , the remainder on division by $x - a$ is $p(a)$ , so $p(a) = 0$ if and only if $(x - a)$ is a factor of $p(x)$ . |
| <a href="#">MAFS.912.A-APR.4.6:</a> | Rewrite simple rational expressions in different forms; write  |

$a(x)/b(x)$  in the form  $q(x) + r(x)/b(x)$ , where  $a(x)$ ,  $b(x)$ ,  $q(x)$ , and  $r(x)$  are polynomials with the degree of  $r(x)$  less than the degree of  $b(x)$ , using inspection, long division, or, for the more complicated examples, a computer algebra system.

[MAFS.912.A-APR.4.7:](#)

Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.

Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★

[MAFS.912.F-IF.3.7:](#)

- Graph linear and quadratic functions and show intercepts, maxima, and minima.
- Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
- Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.
- Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.
- Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.

[MAFS.912.F-IF.3.8:](#)

Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

- Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
- Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as  $y = (1.02)^t$ ,  $y = (0.97)^t$ ,  $y = (1.01)^{2t}$ ,  $y = (1.2)^{t/10}$ , and classify them as representing exponential growth or decay.*

[MAFS.912.F-BF.1.1:](#)

Write a function that describes a relationship between two

quantities. ★

- a. Determine an explicit expression, a recursive process, or steps for calculation from a context.
- b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*
- c. Compose functions. *For example, if  $T(y)$  is the temperature in the atmosphere as a function of height, and  $h(t)$  is the height of a weather balloon as a function of time, then  $T(h(t))$  is the temperature at the location of the weather balloon as a function of time.*

[MAFS.912.F-BF.2.4:](#)

Find inverse functions.

- a. Solve an equation of the form  $f(x) = c$  for a simple function  $f$  that has an inverse and write an expression for the inverse. *For example,  $f(x) = 2x^3$  or  $f(x) = (x+1)/(x-1)$  for  $x \neq 1$ .*
- b. Verify by composition that one function is the inverse of another.
- c. Read values of an inverse function from a graph or a table, given that the function has an inverse.
- d. Produce an invertible function from a non-invertible function by restricting the domain.

[MAFS.912.F-BF.2.5:](#)

Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.

[MAFS.912.F-LE.1.4:](#)

For exponential models, express as a logarithm the solution to  $ab^{ct} = d$  where  $a$ ,  $c$ , and  $d$  are numbers and the base  $b$  is 2, 10, or  $e$ ; evaluate the logarithm using technology. ★

[MAFS.912.F-TF.1.3:](#)

Use special triangles to determine geometrically the values of sine, cosine, tangent for  $\pi/3$ ,  $\pi/4$  and  $\pi/6$ , and use the unit circle to express the values of sine, cosine, and tangent for  $\pi-x$ ,  $\pi+x$ , and  $2\pi-x$  in terms of their values for  $x$ , where  $x$  is any real number.

[MAFS.912.F-TF.1.4:](#)

Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.

[MAFS.912.F-TF.2.5:](#)

Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline. ★

|                                    |   |
|------------------------------------|---|
| <a href="#">MAFS.912.F-TF.2.6:</a> | Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.  |
| <a href="#">MAFS.912.F-TF.2.7:</a> | Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context. ★  |
| <a href="#">MAFS.912.F-TF.3.8:</a> | Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to calculate trigonometric ratios.  |
| <a href="#">LAFS.1112.SL.1.1:</a>  | <p>Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.</p> <ol style="list-style-type: none"> <li>Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.</li> <li>Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.</li> <li>Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.</li> <li>Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task.</li> </ol> |
| <a href="#">LAFS.1112.SL.1.2:</a>  | Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.   |
| <a href="#">LAFS.1112.SL.1.3:</a>  | Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used.   |
| <a href="#">LAFS.1112.SL.2.4:</a>  | Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal   |



|                                     |   |
|-------------------------------------|---|
|                                     | and informal tasks.   |
| <a href="#">LAFS.1112.RST.1.3:</a>  | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.   |
| <a href="#">LAFS.1112.RST.2.4:</a>  | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.  |
| <a href="#">LAFS.1112.RST.3.7:</a>  | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.   |
| <a href="#">LAFS.1112.WHST.1.1:</a> | <p>Write arguments focused on <i>discipline-specific content</i>.</p> <ol style="list-style-type: none"> <li>Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.</li> <li>Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience’s knowledge level, concerns, values, and possible biases.</li> <li>Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.</li> <li>Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.</li> <li>Provide a concluding statement or section that follows from or supports the argument presented.</li> </ol> |
| <a href="#">LAFS.1112.WHST.2.4:</a> | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.  |
| <a href="#">LAFS.1112.WHST.3.9:</a> | Draw evidence from informational texts to support analysis, reflection, and research.   |
| <a href="#">MAFS.K12.MP.1.1:</a>    | <p><b>Make sense of problems and persevere in solving them.</b></p> <p>Mathematically proficient students start by explaining to</p>  |

themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

**Reason abstractly and quantitatively.**

[MAFS.K12.MP.2.1:](#)

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

**Construct viable arguments and critique the reasoning of others.**

[MAFS.K12.MP.3.1:](#)

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them

into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

**Model with mathematics.**

[MAFS.K12.MP.4.1:](#)

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

**Use appropriate tools strategically.**

[MAFS.K12.MP.5.1:](#)

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools

might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

[MAFS.K12.MP.6.1:](#)

**Attend to precision.**

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

[MAFS.K12.MP.7.1:](#)

**Look for and make use of structure.**

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and

y.

**Look for and express regularity in repeated reasoning.**

[MAFS.K12.MP.8.1:](#)

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.AC.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.

## **Science - Grade K (#5020010)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 5020010

**Abbreviated Title:** SCIENCE GRADE K

**Course Length:** Year (Y)

**Course Type:** Core

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** K

### **GENERAL NOTES**

#### **English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Science. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/SC.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

### **COURSE STANDARDS**

#### **Integrate Common Core Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

| Name                        | Description   |
|-----------------------------|---|
| <a href="#">SC.K.N.1.1:</a> | Collaborate with a partner to collect information.<br><br><b>Remarks/Examples:</b><br>Florida Standards Connections: LAFS.KS.1.1 Participate in collaborative conversations with diverse partners about kindergarten topics and texts with peers and adults in small and larger groups.   |
| <a href="#">SC.K.N.1.2:</a> | Make observations of the natural world and know that they are descriptors collected using the five senses.<br><br><b>Remarks/Examples:</b><br>Florida Standards Connections: LAFS.K.W.3.8. With guidance and support from adults, recall information from experiences or gather information experiences or gather information from provided sources to answer a question. |
| <a href="#">SC.K.N.1.3:</a> | Keep records as appropriate -- such as pictorial records -- of investigations conducted.  |
| <a href="#">SC.K.N.1.4:</a> | Observe and create a visual representation of an object which includes its major features.  |
| <a href="#">SC.K.N.1.5:</a> | Recognize that learning can come from careful observation.<br><br><b>Remarks/Examples:</b><br>Florida Standards Connections: MAFS.K12.MP.5: Use appropriate tools strategically and, MAFS.K12.MP.6: Attend precision.   |
| <a href="#">SC.K.E.5.1:</a> | Explore the Law of Gravity by investigating how objects are pulled toward the ground unless something holds them up.  |
| <a href="#">SC.K.E.5.2:</a> | Recognize the repeating pattern of day and night.   |
| <a href="#">SC.K.E.5.3:</a> | Recognize that the Sun can only be seen in the daytime.   |
| <a href="#">SC.K.E.5.4:</a> | Observe that sometimes the Moon can be seen at night and sometimes during the day.  |
| <a href="#">SC.K.E.5.5:</a> | Observe that things can be big and things can be small as seen from Earth.  |
| <a href="#">SC.K.E.5.6:</a> | Observe that some objects are far away and some are nearby as seen from Earth.  |
| <a href="#">SC.K.P.8.1:</a> | Sort objects by observable properties, such as size, shape, color, temperature (hot or cold), weight (heavy or light) and texture.<br><br><b>Remarks/Examples:</b>  |

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|                                | <p>The use of the more familiar term "weight" instead of the term "mass" is recommended for grades K-2.</p> <p>Florida Standards Connections: <a href="#">MAFS.K.MD.2.3</a> Classify objects into given categories count the numbers of objects in each category and sort the categories by count. Note: Limit category counts to be less than or equal to 10.</p>   |
| <a href="#">SC.K.P.9.1:</a>    | Recognize that the shape of materials such as paper and clay can be changed by cutting, tearing, crumpling, smashing, or rolling.  |
| <a href="#">SC.K.P.10.1:</a>   | Observe that things that make sound vibrate.   |
| <a href="#">SC.K.P.12.1:</a>   | Investigate that things move in different ways, such as fast, slow, etc.   |
| <a href="#">SC.K.P.13.1:</a>   | Observe that a push or a pull can change the way an object is moving.  |
| <a href="#">SC.K.L.14.1:</a>   | <p>Recognize the five senses and related body parts.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Integrate <a href="#">HE.K.C.1.5</a>. Recognize there are body parts inside and outside of the body. Related body parts include: eyes, ears, nose, tongue, and skin.</p> </div>  |
| <a href="#">SC.K.L.14.2:</a>   | Recognize that some books and other media portray animals and plants with characteristics and behaviors they do not have in real life.   |
| <a href="#">SC.K.L.14.3:</a>   | <p>Observe plants and animals, describe how they are alike and how they are different in the way they look and in the things they do.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Introduce comparing and contrasting plants and animals by observable physical characteristics and behaviors. Provide students with opportunities to make observations in classrooms and schoolyard environments.</p> </div> |
| <a href="#">MAFS.K.MD.1.2:</a> | Directly compare two objects with a measurable attribute in common, to see which object has "more of"/"less of" the attribute, and describe the difference. <i>For example, directly compare the heights of two children and describe one child as taller/shorter.</i>   |
| <a href="#">MAFS.K.MD.2.3:</a> | Classify objects into given categories; count the numbers of objects in each category and sort the categories by count.  |
| <a href="#">LAFS.K.RI.1.1:</a> | With prompting and support, ask and answer questions about key details in a text.  |
| <a href="#">LAFS.K.RI.2.4:</a> | With prompting and support, ask and answer questions about unknown words in a text.  |



|                                   |   |
|-----------------------------------|---|
| <a href="#">LAFS.K.RI.4.10:</a>   | Actively engage in group reading activities with purpose and understanding.   |
| <a href="#">LAFS.K.W.3.8:</a>     | With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.  |
| <a href="#">LAFS.K.SL.1.1:</a>    | <p>Participate in collaborative conversations with diverse partners about <i>kindergarten topics</i> and texts with peers and adults in small and larger groups.</p> <ol style="list-style-type: none"> <li>a. Follow agreed-upon rules for discussions (e.g., listening to others and taking turns speaking about the topics and texts under discussion).</li> <li>b. Continue a conversation through multiple exchanges.</li> </ol> |
| <a href="#">HE.K.C.1.5:</a>       | <p>Recognize there are body parts inside and outside of the body.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>Remarks/Examples:</b><br/>Brain, muscles, and skin.</p> </div>   |
| <a href="#">ELD.K12.ELL.1.1:</a>  | English language learners communicate for social and instructional purposes within the school setting.  |
| <a href="#">ELD.K12.ELL.XX.1:</a> | English language learners communicate information, ideas and concepts necessary for academic success in the content area of Science.  |

## Science - Grade One (#5020020)

**Version for Academic Year:** 2015 - 2016

**Course Number:** 5020020

**Abbreviated Title:** SCIENCE GRADE ONE

**Course Length:** Year (Y)

**Course Type:** Core

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 1

### GENERAL NOTES

#### **English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Science. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/SC.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

### COURSE STANDARDS

#### **Integrate Common Core Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

| Name                        | Description  |
|-----------------------------|--|
| <a href="#">SC.1.N.1.1:</a> | <p>Raise questions about the natural world, investigate them in teams through free exploration, and generate appropriate explanations based on those explorations.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>           Florida Standards Connections: <a href="#">LAFS.1.SL.1.1</a>. Participate in collaborative conversations with diverse partners about grade 1 topics and texts with peers and adults in groups.</p> </div>  |
| <a href="#">SC.1.N.1.2:</a> | <p>Using the five senses as tools, make careful observations, describe objects in terms of number, shape, texture, size, weight, color, and motion, and compare their observations with others.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>           Florida Standards Connections: <a href="#">LAFS.1.W.3.8</a>. With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.</p> <p>Refer to <a href="#">MAFS.K12.MP.5</a>: Use appropriate tools strategically.</p> </div> |
| <a href="#">SC.1.N.1.3:</a> | <p>Keep records as appropriate - such as pictorial and written records - of investigations conducted.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>           Florida Standards Connections: <a href="#">MAFS.1.MD.3.4</a>. Organize, represent, and interpret data with up to three categories ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.</p> </div>  |
| <a href="#">SC.1.N.1.4:</a> | <p>Ask "how do you know?" in appropriate situations.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>           * Florida Standards Connections: <a href="#">LAFS.1.RI.2.4</a>. Ask and answer questions to help determine or clarify the meaning of words and phrases in a text.</p> </div>   |
| <a href="#">SC.1.E.5.1:</a> | <p>Observe and discuss that there are more stars in the sky than anyone can easily count and that they are not scattered evenly in the sky.</p>  |
| <a href="#">SC.1.E.5.2:</a> | <p>Explore the Law of Gravity by demonstrating that Earth's gravity pulls any object on or near Earth toward it even though nothing is touching the object.</p>  |

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| <a href="#">SC.1.E.5.3:</a>    | Investigate how magnifiers make things appear bigger and help people see things they could not see without them.   |
| <a href="#">SC.1.E.5.4:</a>    | Identify the beneficial and harmful properties of the Sun.   |
| <a href="#">SC.1.E.6.1:</a>    | Recognize that water, rocks, soil, and living organisms are found on Earth's surface.  |
| <a href="#">SC.1.E.6.2:</a>    | Describe the need for water and how to be safe around water.   |
| <a href="#">SC.1.E.6.3:</a>    | Recognize that some things in the world around us happen fast and some happen slowly.<br><div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>Remarks/Examples:</b><br/>Fast: volcanic eruptions, flooding, hurricanes. Slow: drought.</p> </div>  |
| <a href="#">SC.1.P.8.1:</a>    | Sort objects by observable properties, such as size, shape, color, temperature (hot or cold), weight (heavy or light), texture, and whether objects sink or float.<br><div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>Remarks/Examples:</b><br/>The use of the more familiar term "weight" instead of the term "mass" is recommended for grades K-2.</p> </div> |
| <a href="#">SC.1.P.12.1:</a>   | Demonstrate and describe the various ways that objects can move, such as in a straight line, zigzag, back-and-forth, round-and-round, fast, and slow.  |
| <a href="#">SC.1.P.13.1:</a>   | Demonstrate that the way to change the motion of an object is by applying a push or a pull.  |
| <a href="#">SC.1.L.14.1:</a>   | Make observations of living things and their environment using the five senses.<br><div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>Remarks/Examples:</b><br/>Integrate <a href="#">HE.1.C.1.6</a>. Emphasize the correct names of human body parts.</p> </div>  |
| <a href="#">SC.1.L.14.2:</a>   | Identify the major parts of plants, including stem, roots, leaves, and flowers.  |
| <a href="#">SC.1.L.14.3:</a>   | Differentiate between living and nonliving things.   |
| <a href="#">SC.1.L.16.1:</a>   | Make observations that plants and animals closely resemble their parents, but variations exist among individuals within a population.  |
| <a href="#">SC.1.L.17.1:</a>   | Through observation, recognize that all plants and animals, including humans, need the basic necessities of air, water, food, and space.   |
| <a href="#">MAFS.1.MD.3.4:</a> | Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.   |

|                                   |   |
|-----------------------------------|---|
| <a href="#">LAFS.1.RI.1.1:</a>    | Ask and answer questions about key details in a text.   |
| <a href="#">LAFS.1.RI.2.4:</a>    | Ask and answer questions to help determine or clarify the meaning of words and phrases in a text.   |
| <a href="#">LAFS.1.RI.4.10:</a>   | With prompting and support, read informational texts appropriately complex for grade 1.   |
| <a href="#">LAFS.1.W.3.8:</a>     | With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.  |
| <a href="#">LAFS.1.SL.1.1:</a>    | <p>Participate in collaborative conversations with diverse partners about grade 1 topics and texts with peers and adults in small and larger groups.</p> <ol style="list-style-type: none"> <li>a. Follow agreed-upon rules for discussions (e.g., listening to others with care, speaking one at a time about the topics and texts under discussion).</li> <li>b. Build on others' talk in conversations by responding to the comments of others through multiple exchanges.</li> <li>c. Ask questions to clear up any confusion about the topics and texts under discussion.</li> </ol> |
| <a href="#">HE.1.C.1.5:</a>       | <p>Identify the correct names of human body parts.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Stomach, intestines, heart, lungs, skin, muscles, and bones.</p> </div>   |
| <a href="#">ELD.K12.ELL.1.1:</a>  | English language learners communicate for social and instructional purposes within the school setting.  |
| <a href="#">ELD.K12.ELL.XX.1:</a> | English language learners communicate information, ideas and concepts necessary for academic success in the content area of Science.  |

## Science - Grade Two (#5020030)

**Version for Academic Year:** 2015 - 2016

**Course Number:** 5020030

**Abbreviated Title:** SCIENCE GRADE TWO

**Course Length:** Year (Y)

**Course Type:** Core

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 2

### GENERAL NOTES

#### **English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Science. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/SC.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

### COURSE STANDARDS

#### **Integrate Common Core Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

| Name                        | Description   |
|-----------------------------|---|
| <a href="#">SC.2.N.1.1:</a> | Raise questions about the natural world, investigate them in teams through free exploration and systematic observations, and generate appropriate explanations based on those explorations.   |
| <a href="#">SC.2.N.1.2:</a> | <p>Compare the observations made by different groups using the same tools.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>           Compare the observations made by different groups using the same tools.</p> <p>Florida Standards Connections: <a href="#">LAFS.2.SL.1.1</a>. Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in groups.</p> <p>MAFS.K12.MP.5: Use appropriate tools strategically.</p> </div> |
| <a href="#">SC.2.N.1.3:</a> | <p>Ask "how do you know?" in appropriate situations and attempt reasonable answers when asked the same question by others.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>           Florida Standards Connections: <a href="#">LAFS.2.W.3.8</a>. Recall information from experiences or gather information from provided sources to answer a question.</p> </div>  |
| <a href="#">SC.2.N.1.4:</a> | <p>Explain how particular scientific investigations should yield similar conclusions when repeated.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>           Florida Standards Connections: <a href="#">MAFS.2.MD.4.10</a>. Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph.</p> </div>                      |
| <a href="#">SC.2.N.1.5:</a> | <p>Distinguish between empirical observation (what you see, hear, feel, smell, or taste) and ideas or inferences (what you think).</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>           Florida Standards Connections: MAFS.K12.MP.5: Use appropriate tools strategically.</p> </div>   |
| <a href="#">SC.2.N.1.6:</a> | Explain how scientists alone or in groups are always investigating new ways to solve problems.  |

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|                                    | <p><b>Remarks/Examples:</b><br/> * Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them.</p>  |
| <p><a href="#">SC.2.E.6.1:</a></p> | <p>Recognize that Earth is made up of rocks. Rocks come in many sizes and shapes.</p> <p><b>Remarks/Examples:</b><br/> Sizes - boulder, stone, pebble, sand, granular.</p>  |
| <p><a href="#">SC.2.E.6.2:</a></p> | <p>Describe how small pieces of rock and dead plant and animal parts can be the basis of soil and explain the process by which soil is formed.</p>  |
| <p><a href="#">SC.2.E.6.3:</a></p> | <p>Classify soil types based on color, texture (size of particles), the ability to retain water, and the ability to support the growth of plants.</p>   |
| <p><a href="#">SC.2.E.7.1:</a></p> | <p>Compare and describe changing patterns in nature that repeat themselves, such as weather conditions including temperature and precipitation, day to day and season to season.</p>  |
| <p><a href="#">SC.2.E.7.2:</a></p> | <p>Investigate by observing and measuring, that the Sun's energy directly and indirectly warms the water, land, and air.</p> <p><b>Remarks/Examples:</b><br/> Florida Standards Connections: MAFS.K12.MP.5: Use appropriate tools strategically and, MAFS.K12.MP.6: Attend to precision.</p>  |
| <p><a href="#">SC.2.E.7.3:</a></p> | <p>Investigate, observe and describe how water left in an open container disappears (evaporates), but water in a closed container does not disappear (evaporate).</p>   |
| <p><a href="#">SC.2.E.7.4:</a></p> | <p>Investigate that air is all around us and that moving air is wind.</p>   |
| <p><a href="#">SC.2.E.7.5:</a></p> | <p>State the importance of preparing for severe weather, lightning, and other weather related events.</p>   |
| <p><a href="#">SC.2.P.8.1:</a></p> | <p>Observe and measure objects in terms of their properties, including size, shape, color, temperature, weight, texture, sinking or floating in water, and attraction and repulsion of magnets.</p> <p><b>Remarks/Examples:</b><br/> The use of the more familiar term &amp;lsquo weight&amp;rsquo instead of the term &amp;ldquo mass&amp;rdquo is recommended for grades K-2.</p> <p>Florida Standards Connections: MAFS.K12.MP.5: Use appropriate tools strategically and, MAFS.K12.MP.6: Attend</p> |



|                              |  |
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|                              | to precision.  |
| <a href="#">SC.2.P.8.2:</a>  | Identify objects and materials as solid, liquid, or gas.   |
| <a href="#">SC.2.P.8.4:</a>  | Observe and describe water in its solid, liquid, and gaseous states.   |
|                              | Measure and compare temperatures taken every day at the same time.   |
| <a href="#">SC.2.P.8.5:</a>  | <p><b>Remarks/Examples:</b><br/> ** Florida Standards Connections: MAFS.K12.MP.5: Use appropriate tools strategically; and, MAFS.K12.MP.6: Attend to precision.</p>  |
|                              | Measure and compare the volume of liquids using containers of various shapes and sizes.  |
| <a href="#">SC.2.P.8.6:</a>  | <p><b>Remarks/Examples:</b><br/> Recognize the volume of a sample of liquid is independent of the size and shape of the container.</p> <p>Florida Standards Connections: MAFS.K12.MP.5: Use appropriate tools strategically and, MAFS.K12.MP.6: Attend to precision.</p> |
| <a href="#">SC.2.P.8.3:</a>  | Recognize that solids have a definite shape and that liquids and gases take the shape of their container.  |
| <a href="#">SC.2.P.9.1:</a>  | Investigate that materials can be altered to change some of their properties, but not all materials respond the same way to any one alteration.  |
| <a href="#">SC.2.P.10.1:</a> | Discuss that people use electricity or other forms of energy to cook their food, cool or warm their homes, and power their cars.   |
| <a href="#">SC.2.P.13.1:</a> | Investigate the effect of applying various pushes and pulls on different objects.  |
| <a href="#">SC.2.P.13.2:</a> | Demonstrate that magnets can be used to make some things move without touching them.   |
| <a href="#">SC.2.P.13.3:</a> | Recognize that objects are pulled toward the ground unless something holds them up.  |
| <a href="#">SC.2.P.13.4:</a> | Demonstrate that the greater the force (push or pull) applied to an object, the greater the change in motion of the object.  |
|                              | Distinguish human body parts (brain, heart, lungs, stomach, muscles, and skeleton) and their basic functions.  |
| <a href="#">SC.2.L.14.1:</a> | <p><b>Remarks/Examples:</b><br/> Integrate <a href="#">HE.2.C.1.6</a>. Recognize the locations and functions of major human organs. <a href="#">HE.2.B.3.2</a>. Name healthy options to</p>  |

|                                 |   |
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|                                 | health-related issues and problems.   |
| <a href="#">SC.2.L.16.1:</a>    | <p>Observe and describe major stages in the life cycles of plants and animals, including beans and butterflies.</p> <p><b>Remarks/Examples:</b><br/>Other examples for life cycles: peanuts, frogs and meal worms.</p>  |
| <a href="#">SC.2.L.17.1:</a>    | Compare and contrast the basic needs that all living things, including humans, have for survival.   |
| <a href="#">SC.2.L.17.2:</a>    | <p>Recognize and explain that living things are found all over Earth, but each is only able to live in habitats that meet its basic needs.</p> <p><b>Remarks/Examples:</b><br/>Build on knowledge from grade 1 (food, air, water, space). Animals need air, food, water, shelter, and plants need air, water, nutrients, light.</p> |
| <a href="#">MAFS.2.MD.4.9:</a>  | Generate measurement data by measuring lengths of several objects to the nearest whole unit, or by making repeated measurements of the same object. Show the measurements by making a line plot, where the horizontal scale is marked off in whole-number units.  |
| <a href="#">MAFS.2.MD.4.10:</a> | Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph.   |
| <a href="#">LAFS.2.RI.1.3:</a>  | Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text.  |
| <a href="#">LAFS.2.RI.2.4:</a>  | Determine the meaning of words and phrases in a text relevant to a <i>grade 2 topic or subject area</i> .   |
| <a href="#">LAFS.2.RI.4.10:</a> | By the end of year, read and comprehend informational texts, including history/social studies, science, and technical texts, in the grades 2–3 text complexity band proficiently, with scaffolding as needed at the high end of the range.  |
| <a href="#">LAFS.2.W.3.7:</a>   | Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).  |
| <a href="#">LAFS.2.W.3.8:</a>   | Recall information from experiences or gather information from provided sources to answer a question.   |
| <a href="#">LAFS.2.SL.1.1:</a>  | Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and  |

|                                   |  |
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|                                   | <p>larger groups.</p> <ul style="list-style-type: none"> <li>a. Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion).</li> <li>b. Build on others' talk in conversations by linking their comments to the remarks of others.</li> <li>c. Ask for clarification and further explanation as needed about the topics and texts under discussion.</li> </ul> |
|                                   | <p>Recognize the locations and functions of major human organs.</p>  |
| <a href="#">HE.2.C.1.5:</a>       | <p><b>Remarks/Examples:</b><br/>The functions of the heart, lungs, and muscles.</p>  |
|                                   | <p>Name healthy options to health-related issues or problems.</p>  |
| <a href="#">HE.2.B.5.2:</a>       | <p><b>Remarks/Examples:</b><br/>Safety equipment, peer cooperation, and communication.</p>   |
| <a href="#">ELD.K12.ELL.1.1:</a>  | <p>English language learners communicate for social and instructional purposes within the school setting.</p>  |
| <a href="#">ELD.K12.ELL.XX.1:</a> | <p>English language learners communicate information, ideas and concepts necessary for academic success in the content area of Science.</p>  |

## **Science - Grade Three (#5020040)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 5020040

**Abbreviated Title:** SCIENCE GRADE THREE

**Course Length:** Year (Y)

**Course Type:** Core

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 3

### **GENERAL NOTES**

#### **Special Notes:**

##### Instructional Practices

Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:

1. Ensuring wide reading from complex text that varies in length.
2. Making close reading and rereading of texts central to lessons.
3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.
4. Emphasizing students supporting answers based upon evidence from the text.
5. Providing extensive research and writing opportunities (claims and evidence).

#### **English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Science. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/SC.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

## COURSE STANDARDS

### Integrate Common Core Standards for Mathematical Practice (MP) as applicable.

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

| Name                               | Description  |
|------------------------------------|--|
| <p><a href="#">SC.3.N.1.1:</a></p> | <p>Raise questions about the natural world, investigate them individually and in teams through free exploration and systematic investigations, and generate appropriate explanations based on those explorations.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b></p> <p>Florida Standards Connections: <a href="#">LAFS.3.SL.1.1</a>. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 3 topics and texts, building on others’ ideas and expressing their own clearly.</p> <p>Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them and, MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others.</p> </div> |
| <p><a href="#">SC.3.N.1.2:</a></p> | <p>Compare the observations made by different groups using the same tools and seek reasons to explain the differences across groups.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b></p> <p>Florida Standards Connections: <a href="#">LAFS.3.SL.1.1</a>. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 3 topics and texts, building on others’ ideas and expressing their own clearly.</p> <p>Florida Standards Connections: MAFS.K12.MP.5: Use</p> </div>   |

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|                                    | <p>appropriate tools strategically and, MAFS.K12.MP.8: Look for and express regularity in repeated reasoning.</p>  |
| <p><a href="#">SC.3.N.1.3:</a></p> | <p>Keep records as appropriate, such as pictorial, written, or simple charts and graphs, of investigations conducted.</p> <p><b>Remarks/Examples:</b><br/>         Florida Standards Connections: MAFS.K12.MP.5: Use appropriate tools strategically and, MAFS.K12.MP.6: Attend to precision.</p>  |
| <p><a href="#">SC.3.N.1.4:</a></p> | <p>Recognize the importance of communication among scientists.</p> <p><b>Remarks/Examples:</b><br/>         * Florida Standards Connections: <a href="#">LAFS.3.RI.1.3</a>. Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.</p> |
| <p><a href="#">SC.3.N.1.5:</a></p> | <p>Recognize that scientists question, discuss, and check each others' evidence and explanations.</p> <p><b>Remarks/Examples:</b><br/>         ** Florida Standards Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others.</p>   |
| <p><a href="#">SC.3.N.1.6:</a></p> | <p>Infer based on observation.</p> <p><b>Remarks/Examples:</b><br/>         Florida Standards Connections: MAFS.K12.MP.6: Attend to precision.</p>   |
| <p><a href="#">SC.3.N.1.7:</a></p> | <p>Explain that empirical evidence is information, such as observations or measurements, that is used to help validate explanations of natural phenomena.</p> <p><b>Remarks/Examples:</b><br/>         Florida Standards Connections: MAFS.K12.MP.5: Use appropriate tools strategically.</p>  |
| <p><a href="#">SC.3.N.3.1:</a></p> | <p>Recognize that words in science can have different or more specific meanings than their use in everyday language; for example, energy, cell, heat/cold, and evidence.</p> <p><b>Remarks/Examples:</b></p>   |

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|                                    | <p>Florida Standards Connections: <a href="#">LAFS.3.RI.2.4</a>. Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 3 topic or subject area.</p>                                      |
| <p><a href="#">SC.3.N.3.2:</a></p> | <p>Recognize that scientists use models to help understand and explain how things work.</p> <p><b>Remarks/Examples:</b><br/>Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.</p>  |
| <p><a href="#">SC.3.N.3.3:</a></p> | <p>Recognize that all models are approximations of natural phenomena; as such, they do not perfectly account for all observations.</p> <p><b>Remarks/Examples:</b><br/>Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.</p> |
| <p><a href="#">SC.3.E.5.1:</a></p> | <p>Explain that stars can be different; some are smaller, some are larger, and some appear brighter than others; all except the Sun are so far away that they look like points of light.</p>   |
| <p><a href="#">SC.3.E.5.2:</a></p> | <p>Identify the Sun as a star that emits energy; some of it in the form of light.</p>  |
| <p><a href="#">SC.3.E.5.3:</a></p> | <p>Recognize that the Sun appears large and bright because it is the closest star to Earth.</p>  |
| <p><a href="#">SC.3.E.5.4:</a></p> | <p>Explore the Law of Gravity by demonstrating that gravity is a force that can be overcome.</p>   |
| <p><a href="#">SC.3.E.5.5:</a></p> | <p>Investigate that the number of stars that can be seen through telescopes is dramatically greater than those seen by the unaided eye.</p>  |
| <p><a href="#">SC.3.E.6.1:</a></p> | <p>Demonstrate that radiant energy from the Sun can heat objects and when the Sun is not present, heat may be lost.</p>  |
| <p><a href="#">SC.3.P.8.1:</a></p> | <p>Measure and compare temperatures of various samples of solids and liquids.</p> <p><b>Remarks/Examples:</b><br/>Florida Standards Connections: MAFS.K12.MP.5: Use appropriate tools strategically and, MAFS.K12.MP.6: Attend to precision.</p> |
| <p><a href="#">SC.3.P.8.2:</a></p> | <p>Measure and compare the mass and volume of solids and liquids.</p> <p><b>Remarks/Examples:</b><br/>Introduce the term mass as compared to the term weight.</p>  |

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|                                     | <p>Florida Standards Connections: <a href="#">MAFS.3.MD.1.2</a><br/> MAFS.K12.MP.5: Use appropriate tools strategically and,<br/> MAFS.K12.MP.6: Attend to precision.</p>  |
| <p><a href="#">SC.3.P.8.3:</a></p>  | <p>Compare materials and objects according to properties such as size, shape, color, texture, and hardness.</p> <p><b>Remarks/Examples:</b><br/> ** Florida Standards Connections: <a href="#">MAFS.3.MD.2.4</a>;<br/> MAFS.K12.MP.5: Use appropriate tools strategically; and,<br/> MAFS.K12.MP.6: Attend to precision.</p>   |
| <p><a href="#">SC.3.P.9.1:</a></p>  | <p>Describe the changes water undergoes when it changes state through heating and cooling by using familiar scientific terms such as melting, freezing, boiling, evaporation, and condensation.</p>  |
| <p><a href="#">SC.3.P.10.2:</a></p> | <p>Recognize that energy has the ability to cause motion or create change.</p>   |
| <p><a href="#">SC.3.P.10.4:</a></p> | <p>Demonstrate that light can be reflected, refracted, and absorbed.</p>   |
| <p><a href="#">SC.3.P.10.1:</a></p> | <p>Identify some basic forms of energy such as light, heat, sound, electrical, and mechanical.</p>   |
| <p><a href="#">SC.3.P.10.3:</a></p> | <p>Demonstrate that light travels in a straight line until it strikes an object or travels from one medium to another.</p>   |
| <p><a href="#">SC.3.P.11.1:</a></p> | <p>Investigate, observe, and explain that things that give off light often also give off heat.</p>   |
| <p><a href="#">SC.3.P.11.2:</a></p> | <p>Investigate, observe, and explain that heat is produced when one object rubs against another, such as rubbing one's hands together.</p>   |
| <p><a href="#">SC.3.L.14.1:</a></p> | <p>Describe structures in plants and their roles in food production, support, water and nutrient transport, and reproduction.</p> <p><b>Remarks/Examples:</b><br/> Annually assessed on Grade 5 Science FCAT 2.0. Also assesses <a href="#">SC.3.L.14.2</a> and <a href="#">SC.4.L.16.1</a>. Integrate for compare/contrast <a href="#">HE.3.C.1.5</a>. Recognize that body parts and organs work together to form human body systems. n&gt;</p> |
| <p><a href="#">SC.3.L.14.2:</a></p> | <p>Investigate and describe how plants respond to stimuli (heat, light, gravity), such as the way plant stems grow toward light and their roots grow downward in response to gravity.</p>  |
| <p><a href="#">SC.3.L.15.1:</a></p> | <p>Classify animals into major groups (mammals, birds, reptiles, amphibians, fish, arthropods, vertebrates and invertebrates, those having live births and those which lay eggs) according to their physical characteristics and behaviors.</p>  |
| <p><a href="#">SC.3.L.15.2:</a></p> | <p>Classify flowering and nonflowering plants into major groups such</p>   |



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|                                 | as those that produce seeds, or those like ferns and mosses that produce spores, according to their physical characteristics.  |
| <a href="#">SC.3.L.17.1:</a>    | Describe how animals and plants respond to changing seasons.   |
| <a href="#">SC.3.L.17.2:</a>    | Recognize that plants use energy from the Sun, air, and water to make their own food.  |
|                                 | Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l). Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units.  |
| <a href="#">MAFS.3.MD.1.2:</a>  | <p><b>Remarks/Examples:<br/>Examples of Opportunities for In-Depth Focus</b></p> <p>Continuous measurement quantities such as liquid volume, mass, and so on are an important context for fraction arithmetic (cf. 4.NF.2.4c, 5.NF.2.7c, 5.NF.2.3). In grade 3, students begin to get a feel for continuous measurement quantities and solve whole- number problems involving such quantities.</p> |
| <a href="#">MAFS.3.MD.2.4:</a>  | Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units— whole numbers, halves, or quarters.   |
| <a href="#">LAFS.3.RI.1.3:</a>  | Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.   |
| <a href="#">LAFS.3.RI.2.4:</a>  | Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 3 topic or subject area.   |
| <a href="#">LAFS.3.RI.4.10:</a> | By the end of the year, read and comprehend informational texts, including history/social studies, science, and technical texts, at the high end of the grades 2–3 text complexity band independently and proficiently.  |
| <a href="#">LAFS.3.W.3.8:</a>   | Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories.  |
| <a href="#">LAFS.3.SL.1.1:</a>  | Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 3 <i>topics and texts</i> , building on others’ ideas and expressing their own clearly. <ul style="list-style-type: none"> <li>a. Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and</li> </ul>    |

other information known about the topic to explore ideas under discussion.

- b. Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion).
- c. Ask questions to check understanding of information presented, stay on topic, and link their comments to the remarks of others.
- d. Explain their own ideas and understanding in light of the discussion.

[HE.3.C.1.4:](#)

Recognize common childhood health conditions.

**Remarks/Examples:**

Asthma, diabetes, food allergies, dental cavities, and colds.

[HE.3.C.1.5:](#)

Recognize that body parts and organs work together to form human body systems.

**Remarks/Examples:**

Circulatory system, digestive system, nervous system, reproductive system, and other body systems.

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.XX.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Science.

## Science - Grade Four (#5020050)

**Version for Academic Year:** 2015 - 2016

**Course Number:** 5020050

**Abbreviated Title:** SCIENCE GRADE FOUR

**Course Length:** Year (Y)

**Course Type:** Core

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 4

### GENERAL NOTES

#### Special Notes:

##### Instructional Practices

Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:

1. Ensuring wide reading from complex text that varies in length.
2. Making close reading and rereading of texts central to lessons.
3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.
4. Emphasizing students supporting answers based upon evidence from the text.
5. Providing extensive research and writing opportunities (claims and evidence).

Additional content addressed on the Grade 4 NAEP Science assessment includes:

- Earth materials have properties that make them useful in solving human problems and enhancing the quality of life. ([SC.6.E.6.2](#))
- The Sun warms the land, air, and water and helps plants grow. ([SC.3.E.6.1](#); [SC.3.L.17.2](#))
- Weather changes from day to day and during the seasons. ([SC.2.E.7.1](#))
- Scientists use tools for observing, recording, and predicting weather changes. ([SC.5.E.7.3](#); [SC.5.E.7.4](#))
- Plants and animals have life cycles. ([SC.2.L.16.1](#))
- Environment changes impact organism survival and reproduction. ([SC.5.L.15.1](#))
- Organisms need food, water, air, and shelter. ([SC.1.L.17.1](#))
- Some objects are composed of a single substance; others are composed of more than one substance. ([SC.5.P.8.3](#))
- Heat (thermal energy) results when substances burn, materials rub against each other, and electricity flows through wires. ([SC.3.P.11.2](#))
- Metals are conductors of heat and electricity. ([SC.3.P.11.2](#))
- Increasing the temperature of any substance requires the addition of energy.

- Electricity flowing through an electrical circuit produces magnetic effects in the wires. Energy is transferred to the surroundings as light, sound, and heat (thermal energy). ([SC.5.P.11.1](#); [SC.5.P.11.2](#))

The NAEP frameworks for Science may be accessed at <http://www.nagb.org/publications/frameworks/science-09.pdf>

**English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Science. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

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**COURSE STANDARDS**

**Integrate Common Core Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

| Name                        | Description  |
|-----------------------------|--|
| <a href="#">SC.4.N.1.4:</a> | Attempt reasonable answers to scientific questions and cite evidence in support.<br><br><b>Remarks/Examples:</b><br>* Florida Standards Connections: <a href="#">LAFS.4.W.3.8</a> . Recall |

relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.

[LAFS.4.W.3.9](#). Draw evidence from literary or informational texts to support analysis, reflection, and research.

\*\* Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and, MAFS.K12.MP.2: Reason abstractly and quantitatively.

[SC.4.N.1.5:](#)

Compare the methods and results of investigations done by other classmates.

**Remarks/Examples:**

Florida Standards Connections: MAFS.K12.MP.6: Attend to precision.

[SC.4.N.1.1:](#)

Raise questions about the natural world, use appropriate reference materials that support understanding to obtain information (identifying the source), conduct both individual and team investigations through free exploration and systematic investigations, and generate appropriate explanations based on those explorations.

**Remarks/Examples:**

Florida Standards Connections: [LAFS.4.RI.1.3](#). Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.

Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them and, MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others.

[SC.4.N.1.2:](#)

Compare the observations made by different groups using multiple tools and seek reasons to explain the differences across groups.

**Remarks/Examples:**

Florida Standards Connections: [LAFS.4.SL.1.1](#). Engage effectively in a range of collaborative discussions with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly.

Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics and, MAFS.K12.MP.5: Use appropriate

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|                             | tools strategically.  |
| <a href="#">SC.4.N.1.3:</a> | Explain that science does not always follow a rigidly defined method ("the scientific method") but that science does involve the use of observations and empirical evidence.  |
| <a href="#">SC.4.N.1.6:</a> | <p>Keep records that describe observations made, carefully distinguishing actual observations from ideas and inferences about the observations.</p> <p><b>Remarks/Examples:</b><br/> Florida Standards Connections: MAFS.K12.MP.5: Use appropriate tools strategically and, MAFS.K12.MP.6: Attend to precision.</p> |
| <a href="#">SC.4.N.1.7:</a> | <p>Recognize and explain that scientists base their explanations on evidence.</p> <p><b>Remarks/Examples:</b><br/> Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them.</p>  |
| <a href="#">SC.4.N.1.8:</a> | <p>Recognize that science involves creativity in designing experiments.</p> <p><b>Remarks/Examples:</b><br/> Florida Standards Connections: MAFS.K12.MP.5: Use appropriate tools strategically.</p>   |
| <a href="#">SC.4.N.2.1:</a> | Explain that science focuses solely on the natural world.   |
| <a href="#">SC.4.N.3.1:</a> | <p>Explain that models can be three dimensional, two dimensional, an explanation in your mind, or a computer model.</p> <p><b>Remarks/Examples:</b><br/> Florida Standards Connections: MAFS.K12.MP.2: Reason abstractly and quantitatively and, MAFS.K12.MP.4: Model with mathematics.</p>                         |
| <a href="#">SC.4.E.5.1:</a> | <p>Observe that the patterns of stars in the sky stay the same although they appear to shift across the sky nightly, and different stars can be seen in different seasons.</p> <p><b>Remarks/Examples:</b><br/> ** Florida Standards Connections: MAFS.K12.MP.2: Reason abstractly and quantitatively.</p>          |
| <a href="#">SC.4.E.5.2:</a> | Describe the changes in the observable shape of the moon over the course of about a month.  |

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| <p><a href="#">SC.4.E.5.3:</a></p> | <p>Recognize that Earth revolves around the Sun in a year and rotates on its axis in a 24-hour day.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Florida Standards Connections: MAFS.K12.MP.2: Reason abstractly and quantitatively.</p> </div>  |
| <p><a href="#">SC.4.E.5.4:</a></p> | <p>Relate that the rotation of Earth (day and night) and apparent movements of the Sun, Moon, and stars are connected.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Annually assessed on Grade 5 Science FCAT 2.0. Also assesses <a href="#">SC.4.E.5.1</a>, <a href="#">SC.4.E.5.2</a>, and <a href="#">SC.4.E.5.3</a>.</p> <p>Florida Standards Connections: MAFS.K12.MP.2: Reason abstractly and quantitatively.</p> </div> |
| <p><a href="#">SC.4.E.5.5:</a></p> | <p>Investigate and report the effects of space research and exploration on the economy and culture of Florida.</p>  |
| <p><a href="#">SC.4.E.6.1:</a></p> | <p>Identify the three categories of rocks: igneous, (formed from molten rock); sedimentary (pieces of other rocks and fossilized organisms); and metamorphic (formed from heat and pressure).</p>   |
| <p><a href="#">SC.4.E.6.2:</a></p> | <p>Identify the physical properties of common earth-forming minerals, including hardness, color, luster, cleavage, and streak color, and recognize the role of minerals in the formation of rocks.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Annually assessed on Grade 5 Science FCAT 2.0. Also assesses <a href="#">SC.4.E.6.1</a>.</p> </div>  |
| <p><a href="#">SC.4.E.6.3:</a></p> | <p>Recognize that humans need resources found on Earth and that these are either renewable or nonrenewable.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Annually assessed on Grade 5 Science FCAT 2.0. Also assesses <a href="#">SC.4.E.6.1</a>.</p> </div>   |
| <p><a href="#">SC.4.E.6.4:</a></p> | <p>Describe the basic differences between physical weathering (breaking down of rock by wind, water, ice, temperature change, and plants) and erosion (movement of rock by gravity, wind, water, and ice).</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Annually assessed on Grade 5 Science FCAT 2.0.</p> </div>  |
| <p><a href="#">SC.4.E.6.5:</a></p> | <p>Investigate how technology and tools help to extend the ability of humans to observe very small things and very large things.</p>  |

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|                              | <p><b>Remarks/Examples:</b><br/>MAFS.K12.MP.5: Use appropriate tools strategically.</p>   |
| <a href="#">SC.4.E.6.6:</a>  | Identify resources available in Florida (water, phosphate, oil, limestone, silicon, wind, and solar energy).  |
| <a href="#">SC.4.P.8.2:</a>  | Identify properties and common uses of water in each of its states.   |
|                              | Measure and compare objects and materials based on their physical properties including: mass, shape, volume, color, hardness, texture, odor, taste, attraction to magnets.  |
| <a href="#">SC.4.P.8.1:</a>  | <p><b>Remarks/Examples:</b><br/>Investigate the concept of weight versus mass of objects.</p> <p>Florida Standards Connections: MAFS.K12.MP.5: Use appropriate tools strategically and, MAFS.K12.MP.6: Attend to precision.</p> |
|                              | Explore the Law of Conservation of Mass by demonstrating that the mass of a whole object is always the same as the sum of the masses of its parts.  |
| <a href="#">SC.4.P.8.3:</a>  | <p><b>Remarks/Examples:</b><br/>Investigate the concept of weight versus mass of objects.</p> <p>Florida Standards Connections: MAFS.K12.MP.5: Use appropriate tools strategically and, MAFS.K12.MP.6: Attend to precision.</p> |
| <a href="#">SC.4.P.8.4:</a>  | Investigate and describe that magnets can attract magnetic materials and attract and repel other magnets.   |
| <a href="#">SC.4.P.9.1:</a>  | Identify some familiar changes in materials that result in other materials with different characteristics, such as decaying animal or plant matter, burning, rusting, and cooking.  |
| <a href="#">SC.4.P.10.2:</a> | Investigate and describe that energy has the ability to cause motion or create change.  |
| <a href="#">SC.4.P.10.4:</a> | Describe how moving water and air are sources of energy and can be used to move things.   |
| <a href="#">SC.4.P.10.1:</a> | Observe and describe some basic forms of energy, including light, heat, sound, electrical, and the energy of motion.  |
| <a href="#">SC.4.P.10.3:</a> | Investigate and explain that sound is produced by vibrating objects and that pitch depends on how fast or slow the object vibrates.   |
| <a href="#">SC.4.P.11.2:</a> | Identify common materials that conduct heat well or poorly.   |
| <a href="#">SC.4.P.11.1:</a> | Recognize that heat flows from a hot object to a cold object and that heat flow may cause materials to change temperature.  |



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| <a href="#">SC.4.P.12.1:</a> | Recognize that an object in motion always changes its position and may change its direction.  |
| <a href="#">SC.4.P.12.2:</a> | Investigate and describe that the speed of an object is determined by the distance it travels in a unit of time and that objects can move at different speeds.  |
| <a href="#">SC.4.L.16.3:</a> | Recognize that animal behaviors may be shaped by heredity and learning.   |
| <a href="#">SC.4.L.16.1:</a> | Identify processes of sexual reproduction in flowering plants, including pollination, fertilization (seed production), seed dispersal, and germination.   |
| <a href="#">SC.4.L.16.2:</a> | <p>Explain that although characteristics of plants and animals are inherited, some characteristics can be affected by the environment.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Integrate <a href="#">HE.4.C.1.6</a>. Identify the human body parts and organs that work together to form healthy body systems.</p> </div>  |
| <a href="#">SC.4.L.16.4:</a> | <p>Compare and contrast the major stages in the life cycles of Florida plants and animals, such as those that undergo incomplete and complete metamorphosis, and flowering and nonflowering seed-bearing plants.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Annually assessed on Grade 5 Science FCAT 2.0.</p> </div>   |
| <a href="#">SC.4.L.17.1:</a> | Compare the seasonal changes in Florida plants and animals to those in other regions of the country.  |
| <a href="#">SC.4.L.17.2:</a> | Explain that animals, including humans, cannot make their own food and that when animals eat plants or other animals, the energy stored in the food source is passed to them.   |
| <a href="#">SC.4.L.17.3:</a> | <p>Trace the flow of energy from the Sun as it is transferred along the food chain through the producers to the consumers.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Annually assessed on Grade 5 Science FCAT 2.0. Also assesses <a href="#">SC.3.L.17.2</a> and <a href="#">SC.4.L.17.2</a>.</p> </div>  |
| <a href="#">SC.4.L.17.4:</a> | <p>Recognize ways plants and animals, including humans, can impact the environment.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Introduce the impacts of invasive species, such as Brazilian pepper, Cuban anole, Kudzu, Australian pine, non-native pets released into wild (Burmese python). Ocean pollution resulting from discharge of sewage, toxic chemicals,</p> </div> |

|                                 |  |
|---------------------------------|--|
|                                 | <p>manufacturing wastes, fertilizers, soaps, detergents, runoff and insecticides population growth causes consumption of limited resources and land use expansion to accommodate for more people animal extinction (endangered and threatened species).</p>  |
| <a href="#">MAFS.4.MD.1.1:</a>  | <p>Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table. <i>For example, know that 1 ft is 12 times as long as 1 in. Express the length of a 4 ft snake as 48 in. Generate a conversion table for feet and inches listing the number pairs (1, 12), (2, 24), (3, 36), ...</i></p>                               |
| <a href="#">MAFS.4.MD.2.4:</a>  | <p>Make a line plot to display a data set of measurements in fractions of a unit (<math>\frac{1}{2}</math>, <math>\frac{1}{4}</math>, <math>\frac{1}{8}</math>). Solve problems involving addition and subtraction of fractions by using information presented in line plots. <i>For example, from a line plot find and interpret the difference in length between the longest and shortest specimens in an insect collection.</i></p>   |
| <a href="#">LAFS.4.RI.1.3:</a>  | <p>Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.</p>  |
| <a href="#">LAFS.4.RI.2.4:</a>  | <p>Determine the meaning of general academic and domain-specific words or phrases in a text relevant to a <i>grade 4 topic or subject area</i>.</p>  |
| <a href="#">LAFS.4.RI.4.10:</a> | <p>By the end of year, read and comprehend informational texts, including history/social studies, science, and technical texts, in the grades 4–5 text complexity band proficiently, with scaffolding as needed at the high end of the range.</p>  |
| <a href="#">LAFS.4.W.3.8:</a>   | <p>Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.</p>   |
| <a href="#">LAFS.4.W.3.9:</a>   | <p>Draw evidence from literary or informational texts to support analysis, reflection, and research.</p> <ol style="list-style-type: none"> <li>Apply grade 4 Reading standards to literature (e.g., “Describe in depth a character, setting, or event in a story or drama, drawing on specific details in the text [e.g., a character’s thoughts, words, or actions].”).</li> <li>Apply grade 4 Reading standards to informational texts (e.g., “Explain how an author uses reasons and evidence to support particular points in a text”).</li> </ol> |
| <a href="#">LAFS.4.SL.1.1:</a>  | <p>Engage effectively in a range of collaborative discussions (one-on-</p>   |

one, in groups, and teacher-led) with diverse partners on grade 4 *topics and texts*, building on others' ideas and expressing their own clearly.

- a. Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion.
- b. Follow agreed-upon rules for discussions and carry out assigned roles.
- c. Pose and respond to specific questions to clarify or follow up on information, and make comments that contribute to the discussion and link to the remarks of others.
- d. Review the key ideas expressed and explain their own ideas and understanding in light of the discussion.

Identify the human body parts and organs that work together to form healthy body systems.

[HE.4.C.1.5:](#)

**Remarks/Examples:**

Muscular and skeletal systems, circulatory and respiratory systems, and endocrine and reproductive systems.

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.XX.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Science.

## **Science - Grade Five (#5020060)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 5020060

**Abbreviated Title:** SCIENCE GRADE FIVE

**Course Length:** Year (Y)

**Course Type:** Core

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 5

### **GENERAL NOTES**

#### **Special Notes:**

Instructional Practices Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:

1. Ensuring wide reading from complex text that varies in length.
2. Making close reading and rereading of texts central to lessons.
3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.
4. Emphasizing students supporting answers based upon evidence from the text.
5. Providing extensive research and writing opportunities (claims and evidence).

#### **English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Science. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/SC.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

## COURSE STANDARDS

### Integrate Common Core Standards for Mathematical Practice (MP) as applicable.

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

| Name                               | Description   |
|------------------------------------|---|
| <p><a href="#">SC.5.N.1.1:</a></p> | <p>Define a problem, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigations of various types such as: systematic observations, experiments requiring the identification of variables, collecting and organizing data, interpreting data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>           Design and evaluate a written procedure or experimental setup. Annually assessed on Grade 5 Science FCAT 2.0. Also assesses <a href="#">SC.3.N.1.1</a>, <a href="#">SC.4.N.1.1</a>, <a href="#">SC.4.N.1.6</a>, <a href="#">SC.5.N.1.2</a>, and <a href="#">SC.5.N.1.4</a>.</p> <p>Florida Standards Connections: <a href="#">LAFS.5.RI.1.3</a>. Explain the relationships or interactions between two or more individuals, events, ideas, or concepts in a historical, scientific, or technical text based on specific information in the text.<br/> <a href="#">LAFS.5.W.3.8</a>. Recall relevant information from experiences or gather relevant information from print and digital sources summarize or paraphrase information in notes and finished work, and provide a list of sources. <a href="#">MAFS.5.MD.2.2</a>.<br/>           Represent and interpret data. MAFS.5.G.1. Graph points on the coordinate plane to solve real-world and mathematical problems.</p> <p>Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them and, MAFS.K12.MP.2: Reason abstractly and quantitatively.</p> </div> |
| <p><a href="#">SC.5.N.1.2:</a></p> | <p>Explain the difference between an experiment and other types of</p>  |

|                                    |  |
|------------------------------------|--|
|                                    | <p>scientific investigation.</p> <p><b>Remarks/Examples:</b><br/> Explain that an investigation is observing the natural world, without interference, and an experiment involves variables (independent/test and dependent/ outcome) and establishes cause-effect relationships (Schwartz, 2007).</p>  |
| <p><a href="#">SC.5.N.1.3:</a></p> | <p>Recognize and explain the need for repeated experimental trials.</p> <p><b>Remarks/Examples:</b><br/> Florida Standards Connections: MAFS.K12.MP.5: Use appropriate tools strategically and, MAFS.K12.MP.6: Attend to precision.</p>  |
| <p><a href="#">SC.5.N.1.4:</a></p> | <p>Identify a control group and explain its importance in an experiment.</p> <p><b>Remarks/Examples:</b><br/> Florida Standards Connections: MAFS.K12.MP.6: Attend to precision.</p>   |
| <p><a href="#">SC.5.N.1.5:</a></p> | <p>Recognize and explain that authentic scientific investigation frequently does not parallel the steps of "the scientific method."</p> <p><b>Remarks/Examples:</b><br/> Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them and, MAFS.K12.MP.2: Reason abstractly and quantitatively.</p>  |
| <p><a href="#">SC.5.N.1.6:</a></p> | <p>Recognize and explain the difference between personal opinion/interpretation and verified observation.</p>  |
| <p><a href="#">SC.5.N.2.1:</a></p> | <p>Recognize and explain that science is grounded in empirical observations that are testable; explanation must always be linked with evidence.</p> <p><b>Remarks/Examples:</b><br/> Annually assessed on Grade 5 Science FCAT 2.0. Also assesses <a href="#">SC.3.N.1.7</a>, <a href="#">SC.4.N.1.3</a>, <a href="#">SC.4.N.1.7</a>, <a href="#">SC.5.N.1.5</a>, and <a href="#">SC.5.N.1.6</a>.</p> <p>Florida Standards Connections: <a href="#">LAFS.5.W.3.9</a>. Draw evidence from literary or informational texts to support analysis, reflection, and research.</p> <p>Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them and,</p> |

MAFS.K12.MP.2: Reason abstractly and quantitatively and, MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others.

Recognize and explain that when scientific investigations are carried out, the evidence produced by those investigations should be replicable by others.

[SC.5.N.2.2:](#)

**Remarks/Examples:**

Remarks/Examples: Annually assessed on Grade 5 Science FCAT 2.0. Also assesses [SC.3.N.1.2](#), [SC.3.N.1.5](#), [SC.4.N.1.2](#), [SC.4.N.1.5](#), and [SC.5.N.1.3](#).

Florida Standards Connections: [LAFS.5.SL.1.1](#). Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 5 topics and texts, building on others' ideas and expressing their own clearly.

Florida Standards Connections: MAFS.K12.MP.6: Attend to precision.

Recognize that a galaxy consists of gas, dust, and many stars, including any objects orbiting the stars. Identify our home galaxy as the Milky Way.

[SC.5.E.5.1:](#)

**Remarks/Examples:**

Annually assessed on Grade 5 Science FCAT 2.0. Also assesses [SC.3.E.5.1](#), [SC.3.E.5.2](#), and [SC.3.E.5.3](#).

[SC.5.E.5.2:](#)

Recognize the major common characteristics of all planets and compare/contrast the properties of inner and outer planets.

Distinguish among the following objects of the Solar System -- Sun, planets, moons, asteroids, comets -- and identify Earth's position in it.

[SC.5.E.5.3:](#)

**Remarks/Examples:**

Annually assessed on Grade 5 Science FCAT 2.0. Also assesses [SC.5.E.5.2](#).

[SC.5.E.7.1:](#)

Create a model to explain the parts of the water cycle. Water can be a gas, a liquid, or a solid and can go back and forth from one state to another.

**Remarks/Examples:**

Annually assessed on Grade 5 Science FCAT 2.0. Also

|                             |  |
|-----------------------------|--|
|                             | <p>assesses <a href="#">SC.5.E.7.2</a>.</p> <p>Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.</p>   |
| <a href="#">SC.5.E.7.2:</a> | Recognize that the ocean is an integral part of the water cycle and is connected to all of Earth's water reservoirs via evaporation and precipitation processes.   |
| <a href="#">SC.5.E.7.3:</a> | <p>Recognize how air temperature, barometric pressure, humidity, wind speed and direction, and precipitation determine the weather in a particular place and time.</p> <p><b>Remarks/Examples:</b><br/>Annually assessed on Grade 5 Science FCAT 2.0. Also assesses <a href="#">SC.5.E.7.4</a>, <a href="#">SC.5.E.7.5</a>, and <a href="#">SC.5.E.7.6</a>.</p>  |
| <a href="#">SC.5.E.7.4:</a> | Distinguish among the various forms of precipitation (rain, snow, sleet, and hail), making connections to the weather in a particular place and time.  |
| <a href="#">SC.5.E.7.5:</a> | Recognize that some of the weather-related differences, such as temperature and humidity, are found among different environments, such as swamps, deserts, and mountains.  |
| <a href="#">SC.5.E.7.6:</a> | Describe characteristics (temperature and precipitation) of different climate zones as they relate to latitude, elevation, and proximity to bodies of water.   |
| <a href="#">SC.5.E.7.7:</a> | Design a family preparedness plan for natural disasters and identify the reasons for having such a plan.   |
| <a href="#">SC.5.P.8.1:</a> | <p>Compare and contrast the basic properties of solids, liquids, and gases, such as mass, volume, color, texture, and temperature.</p> <p><b>Remarks/Examples:</b><br/>Investigate the concept of weight versus mass of an object. Discuss why mass (not weight) is used to compare properties of solids, liquids and gases. Annually assessed on Grade 5 Science FCAT 2.0. Also assesses <a href="#">SC.3.P.8.1</a>, <a href="#">SC.3.P.8.2</a>, <a href="#">SC.3.P.8.3</a>, and <a href="#">SC.4.P.8.1</a>.</p> <p>MAFS.K12.MP.5: Use appropriate tools strategically and, MAFS.K12.MP.6: Attend to precision.</p> |
| <a href="#">SC.5.P.8.2:</a> | Investigate and identify materials that will dissolve in water and those that will not and identify the conditions that will speed up or slow down the dissolving process.   |
| <a href="#">SC.5.P.8.3:</a> | Demonstrate and explain that mixtures of solids can be separated based on observable properties of their parts such as particle size,  |



shape, color, and magnetic attraction.

**Remarks/Examples:**

Annually assessed on Grade 5 Science FCAT 2.0. Also assesses [SC.5.P.8.2](#).

[SC.5.P.8.4:](#)

Explore the scientific theory of atoms (also called atomic theory) by recognizing that all matter is composed of parts that are too small to be seen without magnification.

**Remarks/Examples:**

Recognize that matter is composed of atoms.

[SC.5.P.9.1:](#)

Investigate and describe that many physical and chemical changes are affected by temperature.

**Remarks/Examples:**

Annually assessed on Grade 5 Science FCAT 2.0. Also assesses [SC.3.P.9.1](#) and [SC.4.P.9.1](#).

[SC.5.P.10.2:](#)

Investigate and explain that energy has the ability to cause motion or create change.

**Remarks/Examples:**

Annually assessed on Grade 5 Science FCAT 2.0. Also assesses [SC.3.P.10.2](#), [SC.4.P.10.2](#), and [SC.4.P.10.4](#).

[SC.5.P.10.1:](#)

Investigate and describe some basic forms of energy, including light, heat, sound, electrical, chemical, and mechanical.

**Remarks/Examples:**

Annually assessed on Grade 5 Science FCAT 2.0. Also assesses [SC.3.P.10.1](#), [SC.3.P.10.3](#), [SC.3.P.10.4](#), [SC.3.P.11.1](#), [SC.3.P.11.2](#), [SC.4.P.10.1](#), and [SC.4.P.10.3](#).

[SC.5.P.10.3:](#)

Investigate and explain that an electrically-charged object can attract an uncharged object and can either attract or repel another charged object without any contact between the objects.

Investigate and explain that electrical energy can be transformed into heat, light, and sound energy, as well as the energy of motion.

[SC.5.P.10.4:](#)

**Remarks/Examples:**

Annually assessed on Grade 5 Science FCAT 2.0. Also assesses [SC.3.E.6.1](#), [SC.4.P.11.1](#), [SC.4.P.11.2](#), [SC.5.P.10.3](#), [SC.5.P.11.1](#), and [SC.5.P.11.2](#).

[SC.5.P.11.2:](#)

Identify and classify materials that conduct electricity and

|                              |   |
|------------------------------|---|
|                              | materials that do not.  |
| <a href="#">SC.5.P.11.1:</a> | Investigate and illustrate the fact that the flow of electricity requires a closed circuit (a complete loop).   |
| <a href="#">SC.5.P.13.1:</a> | Identify familiar forces that cause objects to move, such as pushes or pulls, including gravity acting on falling objects.<br><b>Remarks/Examples:</b><br>Annually assessed on Grade 5 Science FCAT 2.0. Also assesses <a href="#">SC.3.E.5.4</a> and <a href="#">SC.4.P.8.4</a> .  |
| <a href="#">SC.5.P.13.2:</a> | Investigate and describe that the greater the force applied to it, the greater the change in motion of a given object.<br><b>Remarks/Examples:</b><br>Annually assessed on Grade 5 Science FCAT 2.0. Also assesses <a href="#">SC.4.P.12.1</a> , <a href="#">SC.4.P.12.2</a> , <a href="#">SC.5.P.13.3</a> , and <a href="#">SC.5.P.13.4</a> .  |
| <a href="#">SC.5.P.13.3:</a> | Investigate and describe that the more mass an object has, the less effect a given force will have on the object's motion.  |
| <a href="#">SC.5.P.13.4:</a> | Investigate and explain that when a force is applied to an object but it does not move, it is because another opposing force is being applied by something in the environment so that the forces are balanced.  |
| <a href="#">SC.5.L.14.1:</a> | Identify the organs in the human body and describe their functions, including the skin, brain, heart, lungs, stomach, liver, intestines, pancreas, muscles and skeleton, reproductive organs, kidneys, bladder, and sensory organs.<br><b>Remarks/Examples:</b><br>Muscles and skeleton are not organs in the human body and should be referred to as the muscular and skeletal systems and the function of the muscles and skeleton. Integrate HE.5.C.1.6.Explain how human body parts and organs work together in healthy body systems, including the endocrine and reproductive systems. Annually assessed on Grade 5 Science FCAT 2.0 (human body systems are not assessed through this benchmark). |
| <a href="#">SC.5.L.14.2:</a> | Compare and contrast the function of organs and other physical structures of plants and animals, including humans, for example: some animals have skeletons for support -- some with internal skeletons others with exoskeletons -- while some plants have stems for support.<br><b>Remarks/Examples:</b>   |

|                                 |  |
|---------------------------------|--|
|                                 | Annually assessed on Grade 5 Science FCAT 2.0. Also assesses <a href="#">SC.3.L.15.1</a> and <a href="#">SC.3.L.15.2</a> .   |
| <a href="#">SC.5.L.15.1:</a>    | Describe how, when the environment changes, differences between individuals allow some plants and animals to survive and reproduce while others die or move to new locations.  |
| <a href="#">SC.5.L.17.1:</a>    | Compare and contrast adaptations displayed by animals and plants that enable them to survive in different environments such as life cycles variations, animal behaviors and physical characteristics.<br><br><b>Remarks/Examples:</b><br>Annually assessed on Grade 5 Science FCAT 2.0. Also assesses <a href="#">SC.3.L.17.1</a> , <a href="#">SC.4.L.16.2</a> , <a href="#">SC.4.L.16.3</a> , <a href="#">SC.4.L.17.1</a> , <a href="#">SC.4.L.17.4</a> , and <a href="#">SC.5.L.15.1</a> .  |
| <a href="#">MAFS.5.MD.2.2:</a>  | Make a line plot to display a data set of measurements in fractions of a unit ( $\frac{1}{2}$ , $\frac{1}{4}$ , $\frac{1}{8}$ ). Use operations on fractions for this grade to solve problems involving information presented in line plots. <i>For example, given different measurements of liquid in identical beakers, find the amount of liquid each beaker would contain if the total amount in all the beakers were redistributed equally.</i>   |
| <a href="#">MAFS.5.G.1.1:</a>   | Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x-axis and x-coordinate, y-axis and y-coordinate). |
| <a href="#">LAFS.5.RI.1.3:</a>  | Explain the relationships or interactions between two or more individuals, events, ideas, or concepts in a historical, scientific, or technical text based on specific information in the text.  |
| <a href="#">LAFS.5.RI.2.4:</a>  | Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a <i>grade 5 topic or subject area</i> .   |
| <a href="#">LAFS.5.RI.4.10:</a> | By the end of the year, read and comprehend informational texts, including history/social studies, science, and technical texts, at the high end of the grades 4–5 text complexity band independently and proficiently.  |
| <a href="#">LAFS.5.W.3.8:</a>   | Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.   |

|  |  |
|--|--|
| <p><a href="#">LAFS.5.W.3.9:</a></p>     | <p>Draw evidence from literary or informational texts to support analysis, reflection, and research.</p> <ol style="list-style-type: none"> <li>Apply grade 5 Reading standards to literature (e.g., “Compare and contrast two or more characters, settings, or events in a story or a drama, drawing on specific details in the text [e.g., how characters interact]”).</li> <li>Apply grade 5 Reading standards to informational texts (e.g., “Explain how an author uses reasons and evidence to support particular points in a text, identifying which reasons and evidence support which point[s]”).</li> </ol>   |
| <p><a href="#">LAFS.5.SL.1.1:</a></p>    | <p>Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on <i>grade 5 topics and texts</i>, building on others’ ideas and expressing their own clearly.</p> <ol style="list-style-type: none"> <li>Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion.</li> <li>Follow agreed-upon rules for discussions and carry out assigned roles.</li> <li>Pose and respond to specific questions by making comments that contribute to the discussion and elaborate on the remarks of others.</li> <li>Review the key ideas expressed and draw conclusions in light of information and knowledge gained from the discussions.</li> </ol> |
| <p><a href="#">HE.5.C.1.5:</a></p>       | <p>Explain how human body parts and organs work together in healthy body systems, including the endocrine and reproductive systems.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/> Digestive and circulatory systems receiving and distributing nutrients to provide energy, endocrine glands influencing the reproductive system and respiratory system providing oxygen to other body systems.</p> </div>   |
| <p><a href="#">ELD.K12.ELL.1.1:</a></p>  | <p>English language learners communicate for social and instructional purposes within the school setting.</p>  |
| <p><a href="#">ELD.K12.ELL.XX.1:</a></p> | <p>English language learners communicate information, ideas and concepts necessary for academic success in the content area of Science.</p>  |



## **M/J Comprehensive Science 1 (#2002040)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 2002040

**Abbreviated Title:** M/J COMP SCI 1

**Course Length:** Year (Y)

**Course Level:** 2

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 6,7,8

### **GENERAL NOTES**

Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National Science Teachers Association (NSTA) recommends that at the middle school level, all students should have multiple opportunities every week to explore science laboratory investigations (labs). School laboratory investigations are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the middle school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error and have the skills to aggregate, interpret, and present the resulting data (NRC 2006, p. 77; NSTA, 2007).

### **Special Notes:**

#### **Instructional Practices**

Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:

1. Ensuring wide reading from complex text that varies in length.
2. Making close reading and rereading of texts central to lessons.
3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.
4. Emphasizing students supporting answers based upon evidence from the text.
5. Providing extensive research and writing opportunities (claims and evidence).

### **English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Science. For the given level of English

language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

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For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

## COURSE STANDARDS

### Integrate Florida Standards for Mathematical Practice (MP) as applicable.

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

| Name  | Description   |
|---|---|
| <p><a href="#">SC.6.N.1.2:</a></p> <p><a href="#">SC.6.N.1.1:</a></p> | <p>Explain why scientific investigations should be replicable.</p> <p>Define a problem from the sixth grade curriculum, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigation of various types, such as systematic observations or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>           Florida Standards Connections: <a href="#">LAFS.68.RST.1.3</a>. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.</p> </div> |
| <p><a href="#">SC.6.N.1.3:</a></p>                                    | <p>Explain the difference between an experiment and other types of scientific investigation, and explain the relative benefits and limitations of each.</p>   |

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|                                    | <p><b>Remarks/Examples:</b><br/> Explain that an investigation is observing or studying the natural world, without interference or manipulation, and an experiment is an investigation that involves variables (independent/manipulated and dependent/ outcome) and establishes cause-and-effect relationships (Schwartz, 2007).</p>  |
| <p><a href="#">SC.6.N.1.4:</a></p> | <p>Discuss, compare, and negotiate methods used, results obtained, and explanations among groups of students conducting the same investigation.</p>   |
| <p><a href="#">SC.6.N.1.5:</a></p> | <p>Recognize that science involves creativity, not just in designing experiments, but also in creating explanations that fit evidence.</p> <p><b>Remarks/Examples:</b><br/> Florida Standards Connections: <a href="#">LAFS.68.RST.3.7</a><br/> <a href="#">LAFS.68.WHST.1.2</a> and, <a href="#">LAFS.68.WHST.3.9</a>.</p>   |
| <p><a href="#">SC.6.N.2.1:</a></p> | <p>Distinguish science from other activities involving thought.</p> <p><b>Remarks/Examples:</b><br/> Thought refers to any mental or intellectual activity involving an individual's subjective consciousness. Science is a systematic process that pursues, builds and organizes knowledge in the form of testable explanations and predictions about the natural world.</p> |
| <p><a href="#">SC.6.N.2.2:</a></p> | <p>Explain that scientific knowledge is durable because it is open to change as new evidence or interpretations are encountered.</p>  |
| <p><a href="#">SC.6.N.2.3:</a></p> | <p>Recognize that scientists who make contributions to scientific knowledge come from all kinds of backgrounds and possess varied talents, interests, and goals.</p>  |
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| <p><a href="#">SC.6.N.3.4:</a></p> | <p>Identify the role of models in the context of the sixth grade science benchmarks.</p> <p><b>Remarks/Examples:</b><br/> Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.</p>   |
| <p><a href="#">SC.6.N.3.1:</a></p> | <p>Recognize and explain that a scientific theory is a well-supported and widely accepted explanation of nature and is not simply a claim posed by an individual. Thus, the use of the term theory in science is very different than how it is used in everyday life.</p>   |
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|                             | Thus, scientific laws are different from societal laws.   |
| <a href="#">SC.6.E.6.1:</a> | Describe and give examples of ways in which Earth's surface is built up and torn down by physical and chemical weathering, erosion, and deposition.   |
| <a href="#">SC.6.E.6.2:</a> | Recognize that there are a variety of different landforms on Earth's surface such as coastlines, dunes, rivers, mountains, glaciers, deltas, and lakes and relate these landforms as they apply to Florida.<br><br><b>Remarks/Examples:</b><br>Annually assessed on Grade 5 Science FCAT 2.0. Also assesses <a href="#">SC.4.E.6.1</a> .  |
| <a href="#">SC.6.E.7.1:</a> | Differentiate among radiation, conduction, and convection, the three mechanisms by which heat is transferred through Earth's system.  |
| <a href="#">SC.6.E.7.2:</a> | Investigate and apply how the cycling of water between the atmosphere and hydrosphere has an effect on weather patterns and climate.<br><br><b>Remarks/Examples:</b><br>Florida Standards Connections: MAFS.K12.MP.7: Look for and make use of structure.   |
| <a href="#">SC.6.E.7.3:</a> | Describe how global patterns such as the jet stream and ocean currents influence local weather in measurable terms such as temperature, air pressure, wind direction and speed, and humidity and precipitation.<br><br><b>Remarks/Examples:</b><br><br>Florida Standards Connections: MAFS.K12.MP.5: Use appropriate tools strategically MAFS.K12.MP.6: Attend to precision and, MAFS.K12.MP.7: Look for and make use of structure. |
| <a href="#">SC.6.E.7.4:</a> | Differentiate and show interactions among the geosphere, hydrosphere, cryosphere, atmosphere, and biosphere.  |
| <a href="#">SC.6.E.7.5:</a> | Explain how energy provided by the sun influences global patterns of atmospheric movement and the temperature differences between air, water, and land.<br><br><b>Remarks/Examples:</b><br>Florida Standards Connections: MAFS.K12.MP.7: Look for and make use of structure.  |
| <a href="#">SC.6.E.7.6:</a> | Differentiate between weather and climate.  |

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| <a href="#">SC.6.E.7.7:</a>  | Investigate how natural disasters have affected human life in Florida.   |
| <a href="#">SC.6.E.7.8:</a>  | Describe ways human beings protect themselves from hazardous weather and sun exposure.   |
|                              | Describe how the composition and structure of the atmosphere protects life and insulates the planet.   |
| <a href="#">SC.6.E.7.9:</a>  | <p><b>Remarks/Examples:</b><br/>Florida Standards Connections: MAFS.K12.MP.7: Look for and make use of structure.</p>  |
| <a href="#">SC.6.P.11.1:</a> | Explore the Law of Conservation of Energy by differentiating between potential and kinetic energy. Identify situations where kinetic energy is transformed into potential energy and vice versa.   |
|                              | Measure and graph distance versus time for an object moving at a constant speed. Interpret this relationship.  |
| <a href="#">SC.6.P.12.1:</a> | <p><b>Remarks/Examples:</b><br/>Florida Standards Connections: MAFS.K12.MP.5: Use appropriate tools strategically and, MAFS.K12.MP.6: Attend to precision.</p>   |
| <a href="#">SC.6.P.13.1:</a> | Investigate and describe types of forces including contact forces and forces acting at a distance, such as electrical, magnetic, and gravitational.  |
| <a href="#">SC.6.P.13.2:</a> | Explore the Law of Gravity by recognizing that every object exerts gravitational force on every other object and that the force depends on how much mass the objects have and how far apart they are.  |
| <a href="#">SC.6.P.13.3:</a> | Investigate and describe that an unbalanced force acting on an object changes its speed, or direction of motion, or both.  |
|                              | Describe and identify patterns in the hierarchical organization of organisms from atoms to molecules and cells to tissues to organs to organ systems to organisms.   |
| <a href="#">SC.6.L.14.1:</a> | <p><b>Remarks/Examples:</b><br/>Florida Standards Connections: MAFS.K12.MP.7: Look for and make use of structure.</p>  |
| <a href="#">SC.6.L.14.2:</a> | Investigate and explain the components of the scientific theory of cells (cell theory): all organisms are composed of cells (single-celled or multi-cellular), all cells come from pre-existing cells, and cells are the basic unit of life. |
| <a href="#">SC.6.L.14.3:</a> | Recognize and explore how cells of all organisms undergo similar processes to maintain homeostasis, including extracting energy  |

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|                                | from food, getting rid of waste, and reproducing.  |
| <a href="#">SC.6.L.14.4:</a>   | <p>Compare and contrast the structure and function of major organelles of plant and animal cells, including cell wall, cell membrane, nucleus, cytoplasm, chloroplasts, mitochondria, and vacuoles.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Florida Standards Connections: MAFS.K12.MP.7: Look for and make use of structure.</p> </div>  |
| <a href="#">SC.6.L.14.5:</a>   | Identify and investigate the general functions of the major systems of the human body (digestive, respiratory, circulatory, reproductive, excretory, immune, nervous, and musculoskeletal) and describe ways these systems interact with each other to maintain homeostasis.   |
| <a href="#">SC.6.L.14.6:</a>   | <p>Compare and contrast types of infectious agents that may infect the human body, including viruses, bacteria, fungi, and parasites.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Integrate <a href="#">HE.6.C.1.8</a>. Explain how body systems are impacted by hereditary factors and infectious agents.</p> </div>   |
| <a href="#">SC.6.L.15.1:</a>   | Analyze and describe how and why organisms are classified according to shared characteristics with emphasis on the Linnaean system combined with the concept of Domains.   |
| <a href="#">MAFS.6.EE.3.9:</a> | <p>Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. <i>For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation <math>d = 65t</math> to represent the relationship between distance and time.</i></p> |
| <a href="#">MAFS.6.SP.2.4:</a> | Display numerical data in plots on a number line, including dot plots, histograms, and box plots.  |
| <a href="#">MAFS.6.SP.2.5:</a> | <p>Summarize numerical data sets in relation to their context, such as by:</p> <ol style="list-style-type: none"> <li>a. Reporting the number of observations.</li> <li>b. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.</li> <li>c. Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean</li> </ol>   |

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|   | <p>absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.</p> <p>d. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.</p>  |
| <a href="#"><u>LAFS.6.SL.1.1:</u></a>   | <p>Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly.</p> <p>a. Come to discussions prepared, having read or studied required material; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.</p> <p>b. Follow rules for collegial discussions, set specific goals and deadlines, and define individual roles as needed.</p> <p>c. Pose and respond to specific questions with elaboration and detail by making comments that contribute to the topic, text, or issue under discussion.</p> <p>d. Review the key ideas expressed and demonstrate understanding of multiple perspectives through reflection and paraphrasing.</p> |
| <a href="#"><u>LAFS.6.SL.1.2:</u></a>   | Interpret information presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how it contributes to a topic, text, or issue under study.  |
| <a href="#"><u>LAFS.6.SL.1.3:</u></a>   | Delineate a speaker's argument and specific claims, distinguishing claims that are supported by reasons and evidence from claims that are not.  |
| <a href="#"><u>LAFS.6.SL.2.4:</u></a>   | Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume, and clear pronunciation.   |
| <a href="#"><u>LAFS.6.SL.2.5:</u></a>   | Include multimedia components (e.g., graphics, images, music, sound) and visual displays in presentations to clarify information.   |
| <a href="#"><u>LAFS.68.RST.1.1:</u></a> | Cite specific textual evidence to support analysis of science and technical texts.  |
| <a href="#"><u>LAFS.68.RST.1.2:</u></a> | Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.  |
| <a href="#"><u>LAFS.68.RST.1.3:</u></a> | Follow precisely a multistep procedure when carrying out  |

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|                                   | experiments, taking measurements, or performing technical tasks.   |
| <a href="#">LAFS.68.RST.2.4:</a>  | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.   |
| <a href="#">LAFS.68.RST.2.5:</a>  | Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.  |
| <a href="#">LAFS.68.RST.2.6:</a>  | Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.   |
| <a href="#">LAFS.68.RST.3.7:</a>  | Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).  |
| <a href="#">LAFS.68.RST.3.8:</a>  | Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.  |
| <a href="#">LAFS.68.RST.3.9:</a>  | Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.  |
| <a href="#">LAFS.68.WHST.1.1:</a> | <p>Write arguments focused on <i>discipline-specific content</i>.</p> <ol style="list-style-type: none"> <li>a. Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.</li> <li>b. Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.</li> <li>c. Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.</li> <li>d. Establish and maintain a formal style.</li> <li>e. Provide a concluding statement or section that follows from and supports the argument presented.</li> </ol> |
| <a href="#">LAFS.68.WHST.1.2:</a> | <p>Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.</p> <ol style="list-style-type: none"> <li>a. Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information into broader categories as appropriate to achieving purpose; include formatting (e.g., headings), graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension.</li> <li>b. Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.</li> </ol>   |

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|                                    | <ul style="list-style-type: none"> <li>c. Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.</li> <li>d. Use precise language and domain-specific vocabulary to inform about or explain the topic.</li> <li>e. Establish and maintain a formal style and objective tone.</li> <li>f. Provide a concluding statement or section that follows from and supports the information or explanation presented.</li> </ul> |
| <a href="#">LAFS.68.WHST.2.4:</a>  | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.  |
| <a href="#">LAFS.68.WHST.2.5:</a>  | With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.  |
| <a href="#">LAFS.68.WHST.2.6:</a>  | Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.   |
| <a href="#">LAFS.68.WHST.3.7:</a>  | Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.   |
| <a href="#">LAFS.68.WHST.3.8:</a>  | Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.   |
| <a href="#">LAFS.68.WHST.3.9:</a>  | Draw evidence from informational texts to support analysis, reflection, and research.   |
| <a href="#">LAFS.68.WHST.4.10:</a> | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.  |
| <a href="#">HE.6.C.1.3:</a>        | <p>Identify environmental factors that affect personal health.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Air and water quality, availability of sidewalks, contaminated food, and road hazards.</p> </div>   |
| <a href="#">HE.6.C.1.5:</a>        | <p>Explain how body systems are impacted by hereditary factors and infectious agents.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Cystic fibrosis affects respiratory and a digestive system,</p> </div>   |

sickle-cell anemia affects the circulatory system, and influenza affects the respiratory system.

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.XX.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Science.

## **M/J Comprehensive Science 1, Advanced (#2002050)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 2002050

**Abbreviated Title:** M/J COMP SCI 1 ADV

**Course Length:** Year (Y)

**Course Level:** 3

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 6,7,8

### **GENERAL NOTES**

Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National Science Teachers Association (NSTA) recommends that at the middle school level, all students should have multiple opportunities every week to explore science laboratory investigations (labs). School laboratory investigations are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the middle school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (NRC 2006, p. 77; NSTA, 2007).

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|                             | <p>limitations of each.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>           Explain that an investigation is observing or studying the natural world, without interference or manipulation, and an experiment is an investigation that involves variables (independent/manipulated and dependent/ outcome) and establishes cause-and-effect relationships (Schwartz, 2007).</p> </div>              |
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|                             | <p>specific relationship under given conditions in the natural world. Thus, scientific laws are different from societal laws.</p>  |
| <a href="#">SC.6.E.6.1:</a> | <p>Describe and give examples of ways in which Earth's surface is built up and torn down by physical and chemical weathering, erosion, and deposition.</p>   |
| <a href="#">SC.6.E.6.2:</a> | <p>Recognize that there are a variety of different landforms on Earth's surface such as coastlines, dunes, rivers, mountains, glaciers, deltas, and lakes and relate these landforms as they apply to Florida.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Annually assessed on Grade 5 Science FCAT 2.0. Also assesses <a href="#">SC.4.E.6.1</a>.</p> </div>  |
| <a href="#">SC.6.E.7.1:</a> | <p>Differentiate among radiation, conduction, and convection, the three mechanisms by which heat is transferred through Earth's system.</p>  |
| <a href="#">SC.6.E.7.2:</a> | <p>Investigate and apply how the cycling of water between the atmosphere and hydrosphere has an effect on weather patterns and climate.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Florida Standards Connections: MAFS.K12.MP.7: Look for and make use of structure.</p> </div>  |
| <a href="#">SC.6.E.7.3:</a> | <p>Describe how global patterns such as the jet stream and ocean currents influence local weather in measurable terms such as temperature, air pressure, wind direction and speed, and humidity and precipitation.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/><br/>Florida Standards Connections: MAFS.K12.MP.5: Use appropriate tools strategically MAFS.K12.MP.6: Attend to precision and, MAFS.K12.MP.7: Look for and make use of structure.</p> </div> |
| <a href="#">SC.6.E.7.4:</a> | <p>Differentiate and show interactions among the geosphere, hydrosphere, cryosphere, atmosphere, and biosphere.</p>  |
| <a href="#">SC.6.E.7.5:</a> | <p>Explain how energy provided by the sun influences global patterns of atmospheric movement and the temperature differences between air, water, and land.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Florida Standards Connections: MAFS.K12.MP.7: Look for and make use of structure.</p> </div>   |

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| <a href="#">SC.6.E.7.6:</a>  | Differentiate between weather and climate.  |
| <a href="#">SC.6.E.7.7:</a>  | Investigate how natural disasters have affected human life in Florida.  |
| <a href="#">SC.6.E.7.8:</a>  | Describe ways human beings protect themselves from hazardous weather and sun exposure.  |
| <a href="#">SC.6.E.7.9:</a>  | Describe how the composition and structure of the atmosphere protects life and insulates the planet.<br><br><b>Remarks/Examples:</b><br>Florida Standards Connections: MAFS.K12.MP.7: Look for and make use of structure.   |
| <a href="#">SC.6.P.11.1:</a> | Explore the Law of Conservation of Energy by differentiating between potential and kinetic energy. Identify situations where kinetic energy is transformed into potential energy and vice versa.  |
| <a href="#">SC.6.P.12.1:</a> | Measure and graph distance versus time for an object moving at a constant speed. Interpret this relationship.<br><br><b>Remarks/Examples:</b><br>Florida Standards Connections: MAFS.K12.MP.5: Use appropriate tools strategically and, MAFS.K12.MP.6: Attend to precision.             |
| <a href="#">SC.6.P.13.1:</a> | Investigate and describe types of forces including contact forces and forces acting at a distance, such as electrical, magnetic, and gravitational.   |
| <a href="#">SC.6.P.13.2:</a> | Explore the Law of Gravity by recognizing that every object exerts gravitational force on every other object and that the force depends on how much mass the objects have and how far apart they are.   |
| <a href="#">SC.6.P.13.3:</a> | Investigate and describe that an unbalanced force acting on an object changes its speed, or direction of motion, or both.   |
| <a href="#">SC.6.L.14.1:</a> | Describe and identify patterns in the hierarchical organization of organisms from atoms to molecules and cells to tissues to organs to organ systems to organisms.<br><br><b>Remarks/Examples:</b><br>Florida Standards Connections: MAFS.K12.MP.7: Look for and make use of structure. |
| <a href="#">SC.6.L.14.2:</a> | Investigate and explain the components of the scientific theory of cells (cell theory): all organisms are composed of cells (single-celled or multi-cellular), all cells come from pre-existing cells, and cells are the basic unit of life.  |
| <a href="#">SC.6.L.14.3:</a> | Recognize and explore how cells of all organisms undergo similar  |

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|                               | processes to maintain homeostasis, including extracting energy from food, getting rid of waste, and reproducing.  |
| <a href="#">SC.6.L.14.4:</a>  | <p>Compare and contrast the structure and function of major organelles of plant and animal cells, including cell wall, cell membrane, nucleus, cytoplasm, chloroplasts, mitochondria, and vacuoles.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Florida Standards Connections: MAFS.K12.MP.7: Look for and make use of structure.</p> </div>   |
| <a href="#">SC.6.L.14.5:</a>  | Identify and investigate the general functions of the major systems of the human body (digestive, respiratory, circulatory, reproductive, excretory, immune, nervous, and musculoskeletal) and describe ways these systems interact with each other to maintain homeostasis.  |
| <a href="#">SC.6.L.14.6:</a>  | <p>Compare and contrast types of infectious agents that may infect the human body, including viruses, bacteria, fungi, and parasites.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Integrate <a href="#">HE.6.C.1.8</a>. Explain how body systems are impacted by hereditary factors and infectious agents.</p> </div>  |
| <a href="#">SC.6.L.15.1:</a>  | Analyze and describe how and why organisms are classified according to shared characteristics with emphasis on the Linnaean system combined with the concept of Domains.  |
| <a href="#">SC.912.E.7.3:</a> | <p>Differentiate and describe the various interactions among Earth systems, including: atmosphere, hydrosphere, cryosphere, geosphere, and biosphere.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Interactions include transfer of energy (biogeochemical cycles, water cycle, ground and surface waters, photosynthesis, radiation, plate tectonics, conduction, and convection), storms, winds, waves, erosion, currents, deforestation and wildfires, hurricanes, tsunamis, volcanoes.</p> </div> |
| <a href="#">SC.912.E.7.5:</a> | <p>Predict future weather conditions based on present observations and conceptual models and recognize limitations and uncertainties of such predictions.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Use models, weather maps and other tools to predict weather conditions and differentiate between accuracy of short-range and long-range weather forecasts.</p> </div>  |
| <a href="#">SC.912.E.7.6:</a> | Relate the formation of severe weather to the various physical  |

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|                                 | factors.  |
|                                 | <p><b>Remarks/Examples:</b><br/>Identify the causes of severe weather. Compare and contrast physical factors that affect the formation of severe weather events (e.g. hurricanes, tornados, flash floods, thunderstorms, and drought).</p>  |
| <a href="#">SC.912.P.10.4:</a>  | Describe heat as the energy transferred by convection, conduction, and radiation, and explain the connection of heat to change in temperature or states of matter.  |
| <a href="#">SC.912.L.14.2:</a>  | Relate structure to function for the components of plant and animal cells. Explain the role of cell membranes as a highly selective barrier (passive and active transport).   |
| <a href="#">SC.912.L.14.3:</a>  | Compare and contrast the general structures of plant and animal cells. Compare and contrast the general structures of prokaryotic and eukaryotic cells.   |
|                                 | <p><b>Remarks/Examples:</b><br/>Annually Assessed on Biology EOC. Also assesses <a href="#">SC.912.L.14.2</a>.</p>  |
| <a href="#">SC.912.L.16.14:</a> | Describe the cell cycle, including the process of mitosis. Explain the role of mitosis in the formation of new cells and its importance in maintaining chromosome number during asexual reproduction.   |
| <a href="#">MAFS.6.EE.3.9:</a>  | Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. <i>For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation <math>d = 65t</math> to represent the relationship between distance and time.</i> |
| <a href="#">MAFS.6.SP.1.3:</a>  | Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.   |
| <a href="#">MAFS.6.SP.2.4:</a>  | Display numerical data in plots on a number line, including dot plots, histograms, and box plots.   |
| <a href="#">MAFS.6.SP.2.5:</a>  | Summarize numerical data sets in relation to their context, such as by: <ul style="list-style-type: none"> <li>a. Reporting the number of observations.</li> </ul>  |

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|                                | <ul style="list-style-type: none"> <li>b. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.</li> <li>c. Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.</li> <li>d. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.</li> </ul>  |
| <a href="#">MAFS.7.SP.2.4:</a> | <p>Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations. <i>For example, decide whether the words in a chapter of a seventh-grade science book are generally longer than the words in a chapter of a fourth-grade science book.</i></p>   |
| <a href="#">MAFS.7.SP.3.5:</a> | <p>Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.</p>   |
| <a href="#">LAFS.6.SL.1.1:</a> | <p>Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly.</p> <ul style="list-style-type: none"> <li>a. Come to discussions prepared, having read or studied required material; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.</li> <li>b. Follow rules for collegial discussions, set specific goals and deadlines, and define individual roles as needed.</li> <li>c. Pose and respond to specific questions with elaboration and detail by making comments that contribute to the topic, text, or issue under discussion.</li> <li>d. Review the key ideas expressed and demonstrate understanding of multiple perspectives through reflection and paraphrasing.</li> </ul> |
| <a href="#">LAFS.6.SL.1.2:</a> | <p>Interpret information presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how it contributes to a</p>   |

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|                                   | topic, text, or issue under study.  |
| <a href="#">LAFS.6.SL.1.3:</a>    | Delineate a speaker’s argument and specific claims, distinguishing claims that are supported by reasons and evidence from claims that are not.  |
| <a href="#">LAFS.6.SL.2.4:</a>    | Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume, and clear pronunciation.   |
| <a href="#">LAFS.6.SL.2.5:</a>    | Include multimedia components (e.g., graphics, images, music, sound) and visual displays in presentations to clarify information.   |
| <a href="#">LAFS.68.RST.1.1:</a>  | Cite specific textual evidence to support analysis of science and technical texts.  |
| <a href="#">LAFS.68.RST.1.2:</a>  | Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.  |
| <a href="#">LAFS.68.RST.1.3:</a>  | Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.   |
| <a href="#">LAFS.68.RST.2.4:</a>  | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.  |
| <a href="#">LAFS.68.RST.2.5:</a>  | Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.   |
| <a href="#">LAFS.68.RST.2.6:</a>  | Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.  |
| <a href="#">LAFS.68.RST.3.7:</a>  | Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).   |
| <a href="#">LAFS.68.RST.3.8:</a>  | Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.   |
| <a href="#">LAFS.68.RST.3.9:</a>  | Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.   |
|                                   | Write arguments focused on <i>discipline-specific content</i> .   |
| <a href="#">LAFS.68.WHST.1.1:</a> | <ol style="list-style-type: none"> <li>a. Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.</li> <li>b. Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.</li> <li>c. Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims,</li> </ol> |



- reasons, and evidence.
- d. Establish and maintain a formal style.
- e. Provide a concluding statement or section that follows from and supports the argument presented.

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| <p><a href="#">LAFS.68.WHST.1.2:</a></p> | <p>Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.</p> <ul style="list-style-type: none"> <li>a. Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information into broader categories as appropriate to achieving purpose; include formatting (e.g., headings), graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension.</li> <li>b. Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.</li> <li>c. Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.</li> <li>d. Use precise language and domain-specific vocabulary to inform about or explain the topic.</li> <li>e. Establish and maintain a formal style and objective tone.</li> <li>f. Provide a concluding statement or section that follows from and supports the information or explanation presented.</li> </ul> |
| <p><a href="#">LAFS.68.WHST.2.4:</a></p> | <p>Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.</p>   |
| <p><a href="#">LAFS.68.WHST.2.5:</a></p> | <p>With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.</p>   |
| <p><a href="#">LAFS.68.WHST.2.6:</a></p> | <p>Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.</p>  |
| <p><a href="#">LAFS.68.WHST.3.7:</a></p> | <p>Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.</p>  |
| <p><a href="#">LAFS.68.WHST.3.8:</a></p> | <p>Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.</p>  |

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| <a href="#">LAFS.68.WHST.3.9:</a>  | Draw evidence from informational texts to support analysis reflection, and research.  |
| <a href="#">LAFS.68.WHST.4.10:</a> | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.  |
| <a href="#">HE.6.C.1.3:</a>        | <p>Identify environmental factors that affect personal health.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Air and water quality, availability of sidewalks, contaminated food, and road hazards.</p> </div>  |
| <a href="#">HE.6.C.1.5:</a>        | <p>Explain how body systems are impacted by hereditary factors and infectious agents.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Cystic fibrosis affects respiratory and a digestive system, sickle-cell anemia affects the circulatory system, and influenza affects the respiratory system.</p> </div> |
| <a href="#">ELD.K12.ELL.1.1:</a>   | English language learners communicate for social and instructional purposes within the school setting.  |
| <a href="#">ELD.K12.ELL.XX.1:</a>  | English language learners communicate information, ideas and concepts necessary for academic success in the content area of Science.  |

## **M/J Comprehensive Science 2 (#2002070)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 2002070

**Abbreviated Title:** M/J COMPRE SCI 2

**Course Length:** Year (Y)

**Course Level:** 2

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 6,7,8

### **GENERAL NOTES**

Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National Science Teachers Association (NSTA) recommends that at the middle school level, all students should have multiple opportunities every week to explore science laboratory investigations (labs). School laboratory investigations are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the middle school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error and have the skills to aggregate, interpret, and present the resulting data (NRC 2006, p. 77; NSTA, 2007).

### **Special Notes:**

#### **Instructional Practices**

Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:

1. Ensuring wide reading from complex text that varies in length.
2. Making close reading and rereading of texts central to lessons.
3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.
4. Emphasizing students supporting answers based upon evidence from the text.
5. Providing extensive research and writing opportunities (claims and evidence).

### English Language Development ELD Standards Special Notes Section:

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Science. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/SC.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

### COURSE STANDARDS

#### Integrate Florida Standards for Mathematical Practice (MP) as applicable.

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

| Name                        | Description  |
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| <a href="#">SC.7.N.1.2:</a> | Differentiate replication (by others) from repetition (multiple trials).   |
| <a href="#">SC.7.N.1.1:</a> | Define a problem from the seventh grade curriculum, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigation of various types, such as systematic observations or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions. |
|                             | <b>Remarks/Examples:</b>   |

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|                             | Florida Standards Connections: LAFS.68.RST.1.3. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.   |
| <a href="#">SC.7.N.1.3:</a> | Distinguish between an experiment (which must involve the identification and control of variables) and other forms of scientific investigation and explain that not all scientific knowledge is derived from experimentation.   |
| <a href="#">SC.7.N.1.4:</a> | Identify test variables (independent variables) and outcome variables (dependent variables) in an experiment.   |
| <a href="#">SC.7.N.1.5:</a> | Describe the methods used in the pursuit of a scientific explanation as seen in different fields of science such as biology, geology, and physics.  |
| <a href="#">SC.7.N.1.6:</a> | Explain that empirical evidence is the cumulative body of observations of a natural phenomenon on which scientific explanations are based.  |
| <a href="#">SC.7.N.1.7:</a> | Explain that scientific knowledge is the result of a great deal of debate and confirmation within the science community.  |
| <a href="#">SC.7.N.2.1:</a> | Identify an instance from the history of science in which scientific knowledge has changed when new evidence or new interpretations are encountered.  |
| <a href="#">SC.7.N.3.2:</a> | Identify the benefits and limitations of the use of scientific models.<br><div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>Remarks/Examples:</b><br/>Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.</p> </div>   |
| <a href="#">SC.7.N.3.1:</a> | Recognize and explain the difference between theories and laws and give several examples of scientific theories and the evidence that supports them.  |
| <a href="#">SC.7.E.6.1:</a> | Describe the layers of the solid Earth, including the lithosphere, the hot convecting mantle, and the dense metallic liquid and solid cores.  |
| <a href="#">SC.7.E.6.2:</a> | Identify the patterns within the rock cycle and relate them to surface events (weathering and erosion) and sub-surface events (plate tectonics and mountain building).<br><div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>Remarks/Examples:</b><br/>Florida Standards Connections: MAFS.K12.MP.7: Look for and make use of structure.</p> </div> |
| <a href="#">SC.7.E.6.3:</a> | Identify current methods for measuring the age of Earth and its   |

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|                              | parts, including the law of superposition and radioactive dating.  |
| <a href="#">SC.7.E.6.4:</a>  | Explain and give examples of how physical evidence supports scientific theories that Earth has evolved over geologic time due to natural processes.  |
| <a href="#">SC.7.E.6.5:</a>  | Explore the scientific theory of plate tectonics by describing how the movement of Earth's crustal plates causes both slow and rapid changes in Earth's surface, including volcanic eruptions, earthquakes, and mountain building. |
| <a href="#">SC.7.E.6.6:</a>  | Identify the impact that humans have had on Earth, such as deforestation, urbanization, desertification, erosion, air and water quality, changing the flow of water.   |
| <a href="#">SC.7.E.6.7:</a>  | Recognize that heat flow and movement of material within Earth causes earthquakes and volcanic eruptions, and creates mountains and ocean basins.  |
| <a href="#">SC.7.P.10.2:</a> | Observe and explain that light can be reflected, refracted, and/or absorbed.   |
| <a href="#">SC.7.P.10.1:</a> | Illustrate that the sun's energy arrives as radiation with a wide range of wavelengths, including infrared, visible, and ultraviolet, and that white light is made up of a spectrum of many different colors.                      |
| <a href="#">SC.7.P.10.3:</a> | Recognize that light waves, sound waves, and other waves move at different speeds in different materials.  |
| <a href="#">SC.7.P.11.2:</a> | Investigate and describe the transformation of energy from one form to another.  |
| <a href="#">SC.7.P.11.1:</a> | Recognize that adding heat to or removing heat from a system may result in a temperature change and possibly a change of state.  |
| <a href="#">SC.7.P.11.3:</a> | Cite evidence to explain that energy cannot be created nor destroyed, only changed from one form to another.   |
| <a href="#">SC.7.P.11.4:</a> | Observe and describe that heat flows in predictable ways, moving from warmer objects to cooler ones until they reach the same temperature.   |
| <a href="#">SC.7.L.15.1:</a> | Recognize that fossil evidence is consistent with the scientific theory of evolution that living things evolved from earlier species.  |
| <a href="#">SC.7.L.15.2:</a> | Explore the scientific theory of evolution by recognizing and explaining ways in which genetic variation and environmental factors contribute to evolution by natural selection and diversity of organisms.                        |
| <a href="#">SC.7.L.15.3:</a> | Explore the scientific theory of evolution by relating how the inability of a species to adapt within a changing environment may contribute to the extinction of that species.   |
| <a href="#">SC.7.L.16.1:</a> | Understand and explain that every organism requires a set of instructions that specifies its traits, that this hereditary information (DNA) contains genes located in the chromosomes of each cell,                                |

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|                                | and that heredity is the passage of these instructions from one generation to another.   |
|                                | <p><b>Remarks/Examples:</b><br/>Integrate <a href="#">HE.7.C.1.4</a>. Describe how heredity can affect personal health.</p>  |
| <a href="#">SC.7.L.16.2:</a>   | Determine the probabilities for genotype and phenotype combinations using Punnett Squares and pedigrees.   |
| <a href="#">SC.7.L.16.3:</a>   | Compare and contrast the general processes of sexual reproduction requiring meiosis and asexual reproduction requiring mitosis.  |
|                                | Recognize and explore the impact of biotechnology (cloning, genetic engineering, artificial selection) on the individual, society and the environment.   |
| <a href="#">SC.7.L.16.4:</a>   | <p><b>Remarks/Examples:</b><br/>Integrate <a href="#">HE.7.C.1.4</a>. Describe how heredity can affect personal health.</p>  |
| <a href="#">SC.7.L.17.1:</a>   | Explain and illustrate the roles of and relationships among producers, consumers, and decomposers in the process of energy transfer in a food web.   |
| <a href="#">SC.7.L.17.2:</a>   | Compare and contrast the relationships among organisms such as mutualism, predation, parasitism, competition, and commensalism.  |
| <a href="#">SC.7.L.17.3:</a>   | Describe and investigate various limiting factors in the local ecosystem and their impact on native populations, including food, shelter, water, space, disease, parasitism, predation, and nesting sites. |
|                                | Analyze how environmental factors affect personal health.  |
| <a href="#">HE.7.C.1.3:</a>    | <p><b>Remarks/Examples:</b><br/>Some examples may include food refrigeration, appropriate home heating and cooling, water quality, garbage/trash collection.</p>   |
| <a href="#">HE.7.C.1.8:</a>    | Classify infectious agents and their modes of transmission to the human body.  |
|                                | <p><b>Remarks/Examples:</b><br/>Some examples may include HIV by sexual transmission and/or shared needles, etc.; Lyme's disease by vectors; staphylococcus by direct/indirect contact.</p>                |
| <a href="#">MAFS.7.SP.2.4:</a> | Use measures of center and measures of variability for numerical   |

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|                                  | <p>data from random samples to draw informal comparative inferences about two populations. <i>For example, decide whether the words in a chapter of a seventh-grade science book are generally longer than the words in a chapter of a fourth-grade science book.</i></p>  |
| <a href="#">MAFS.7.SP.3.5:</a>   | <p>Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.</p>   |
| <a href="#">LAFS.7.SL.1.1:</a>   | <p>Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 7 topics, texts, and issues, building on others' ideas and expressing their own clearly.</p> <ol style="list-style-type: none"> <li>a. Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.</li> <li>b. Follow rules for collegial discussions, track progress toward specific goals and deadlines, and define individual roles as needed.</li> <li>c. Pose questions that elicit elaboration and respond to others' questions and comments with relevant observations and ideas that bring the discussion back on topic as needed.</li> <li>d. Acknowledge new information expressed by others and, when warranted, modify their own views.</li> </ol> |
| <a href="#">LAFS.7.SL.1.2:</a>   | <p>Analyze the main ideas and supporting details presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how the ideas clarify a topic, text, or issue under study.</p>  |
| <a href="#">LAFS.7.SL.1.3:</a>   | <p>Delineate a speaker's argument and specific claims, evaluating the soundness of the reasoning and the relevance and sufficiency of the evidence.</p>  |
| <a href="#">LAFS.7.SL.2.4:</a>   | <p>Present claims and findings, emphasizing salient points in a focused, coherent manner with pertinent descriptions, facts, details, and examples; use appropriate eye contact, adequate volume, and clear pronunciation.</p>   |
| <a href="#">LAFS.7.SL.2.5:</a>   | <p>Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points.</p>   |
| <a href="#">LAFS.68.RST.1.1:</a> | <p>Cite specific textual evidence to support analysis of science and technical texts.</p>  |



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| <a href="#">LAFS.68.RST.1.2:</a>  | Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.   |
| <a href="#">LAFS.68.RST.1.3:</a>  | Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.  |
| <a href="#">LAFS.68.RST.2.4:</a>  | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.   |
| <a href="#">LAFS.68.RST.2.5:</a>  | Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.  |
| <a href="#">LAFS.68.RST.2.6:</a>  | Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.   |
| <a href="#">LAFS.68.RST.3.7:</a>  | Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).  |
| <a href="#">LAFS.68.RST.3.8:</a>  | Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.  |
| <a href="#">LAFS.68.RST.3.9:</a>  | Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.  |
|                                   | Write arguments focused on <i>discipline-specific content</i> .  |
| <a href="#">LAFS.68.WHST.1.1:</a> | <ol style="list-style-type: none"> <li>a. Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.</li> <li>b. Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.</li> <li>c. Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.</li> <li>d. Establish and maintain a formal style.</li> <li>e. Provide a concluding statement or section that follows from and supports the argument presented.</li> </ol> |
| <a href="#">LAFS.68.WHST.1.2:</a> | <p>Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.</p> <ol style="list-style-type: none"> <li>a. Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information into broader categories as appropriate to achieving purpose; include formatting (e.g., headings), graphics (e.g., charts, tables),</li> </ol>   |

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|                                    | <p>and multimedia when useful to aiding comprehension.</p> <ol style="list-style-type: none"> <li>b. Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.</li> <li>c. Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.</li> <li>d. Use precise language and domain-specific vocabulary to inform about or explain the topic.</li> <li>e. Establish and maintain a formal style and objective tone.</li> <li>f. Provide a concluding statement or section that follows from and supports the information or explanation presented.</li> </ol> |
| <a href="#">LAFS.68.WHST.2.4:</a>  | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.   |
| <a href="#">LAFS.68.WHST.2.5:</a>  | With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.   |
| <a href="#">LAFS.68.WHST.2.6:</a>  | Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.  |
| <a href="#">LAFS.68.WHST.3.7:</a>  | Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.  |
| <a href="#">LAFS.68.WHST.3.8:</a>  | Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.  |
| <a href="#">LAFS.68.WHST.3.9:</a>  | Draw evidence from informational texts to support analysis, reflection, and research.  |
| <a href="#">LAFS.68.WHST.4.10:</a> | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.   |
| <a href="#">ELD.K12.ELL.1.1:</a>   | English language learners communicate for social and instructional purposes within the school setting.   |
| <a href="#">ELD.K12.ELL.XX.1:</a>  | English language learners communicate information, ideas and concepts necessary for academic success in the content area of Science.   |



## **M/J Comprehensive Science 2, Advanced (#2002080)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 2002080

**Abbreviated Title:** M/J COMPRE SCI 2 ADV

**Course Length:** Year (Y)

**Course Level:** 3

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 6,7,8

### **GENERAL NOTES**

Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National Science Teachers Association (NSTA) recommends that at the middle school level, all students should have multiple opportunities every week to explore science laboratory investigations (labs). School laboratory investigations are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the middle school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (NRC 2006, p. 77; NSTA, 2007).

### **Special Notes:**

#### **Instructional Practices**

Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:

1. Ensuring wide reading from complex text that varies in length.
2. Making close reading and rereading of texts central to lessons.
3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.
4. Emphasizing students supporting answers based upon evidence from the text.
5. Providing extensive research and writing opportunities (claims and evidence).

#### **English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts

for academic success in the content area of Science. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/SC.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

## COURSE STANDARDS

### Integrate Florida Standards for Mathematical Practice (MP) as applicable.

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

| Name                        | Description  |
|-----------------------------|--|
| <a href="#">SC.7.N.1.2:</a> | Differentiate replication (by others) from repetition (multiple trials).   |
| <a href="#">SC.7.N.1.1:</a> | <p>Define a problem from the seventh grade curriculum, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigation of various types, such as systematic observations or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b></p> <p>Florida Standards Connections: LAFS.68.RST.1.3. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical</p> </div> |

|                             |   |
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|                             | tasks.  |
| <a href="#">SC.7.N.1.3:</a> | Distinguish between an experiment (which must involve the identification and control of variables) and other forms of scientific investigation and explain that not all scientific knowledge is derived from experimentation.   |
| <a href="#">SC.7.N.1.4:</a> | Identify test variables (independent variables) and outcome variables (dependent variables) in an experiment.   |
| <a href="#">SC.7.N.1.5:</a> | Describe the methods used in the pursuit of a scientific explanation as seen in different fields of science such as biology, geology, and physics.  |
| <a href="#">SC.7.N.1.6:</a> | Explain that empirical evidence is the cumulative body of observations of a natural phenomenon on which scientific explanations are based.  |
| <a href="#">SC.7.N.1.7:</a> | Explain that scientific knowledge is the result of a great deal of debate and confirmation within the science community.  |
| <a href="#">SC.7.N.2.1:</a> | Identify an instance from the history of science in which scientific knowledge has changed when new evidence or new interpretations are encountered.  |
| <a href="#">SC.7.N.3.2:</a> | Identify the benefits and limitations of the use of scientific models.<br><br><b>Remarks/Examples:</b><br>Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.   |
| <a href="#">SC.7.N.3.1:</a> | Recognize and explain the difference between theories and laws and give several examples of scientific theories and the evidence that supports them.  |
| <a href="#">SC.7.E.6.1:</a> | Describe the layers of the solid Earth, including the lithosphere, the hot convecting mantle, and the dense metallic liquid and solid cores.  |
| <a href="#">SC.7.E.6.2:</a> | Identify the patterns within the rock cycle and relate them to surface events (weathering and erosion) and sub-surface events (plate tectonics and mountain building).<br><br><b>Remarks/Examples:</b><br>Florida Standards Connections: MAFS.K12.MP.7: Look for and make use of structure. |
| <a href="#">SC.7.E.6.3:</a> | Identify current methods for measuring the age of Earth and its parts, including the law of superposition and radioactive dating.   |
| <a href="#">SC.7.E.6.4:</a> | Explain and give examples of how physical evidence supports scientific theories that Earth has evolved over geologic time due to natural processes.   |

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| <a href="#"><u>SC.7.E.6.5:</u></a>  | Explore the scientific theory of plate tectonics by describing how the movement of Earth's crustal plates causes both slow and rapid changes in Earth's surface, including volcanic eruptions, earthquakes, and mountain building.   |
| <a href="#"><u>SC.7.E.6.6:</u></a>  | Identify the impact that humans have had on Earth, such as deforestation, urbanization, desertification, erosion, air and water quality, changing the flow of water.   |
| <a href="#"><u>SC.7.E.6.7:</u></a>  | Recognize that heat flow and movement of material within Earth causes earthquakes and volcanic eruptions, and creates mountains and ocean basins.  |
| <a href="#"><u>SC.7.P.10.2:</u></a> | Observe and explain that light can be reflected, refracted, and/or absorbed.   |
| <a href="#"><u>SC.7.P.10.1:</u></a> | Illustrate that the sun's energy arrives as radiation with a wide range of wavelengths, including infrared, visible, and ultraviolet, and that white light is made up of a spectrum of many different colors.  |
| <a href="#"><u>SC.7.P.10.3:</u></a> | Recognize that light waves, sound waves, and other waves move at different speeds in different materials.  |
| <a href="#"><u>SC.7.P.11.2:</u></a> | Investigate and describe the transformation of energy from one form to another.  |
| <a href="#"><u>SC.7.P.11.1:</u></a> | Recognize that adding heat to or removing heat from a system may result in a temperature change and possibly a change of state.  |
| <a href="#"><u>SC.7.P.11.3:</u></a> | Cite evidence to explain that energy cannot be created nor destroyed, only changed from one form to another.   |
| <a href="#"><u>SC.7.P.11.4:</u></a> | Observe and describe that heat flows in predictable ways, moving from warmer objects to cooler ones until they reach the same temperature.   |
| <a href="#"><u>SC.7.L.15.1:</u></a> | Recognize that fossil evidence is consistent with the scientific theory of evolution that living things evolved from earlier species.  |
| <a href="#"><u>SC.7.L.15.2:</u></a> | Explore the scientific theory of evolution by recognizing and explaining ways in which genetic variation and environmental factors contribute to evolution by natural selection and diversity of organisms.  |
| <a href="#"><u>SC.7.L.15.3:</u></a> | Explore the scientific theory of evolution by relating how the inability of a species to adapt within a changing environment may contribute to the extinction of that species.   |
| <a href="#"><u>SC.7.L.16.1:</u></a> | Understand and explain that every organism requires a set of instructions that specifies its traits, that this hereditary information (DNA) contains genes located in the chromosomes of each cell, and that heredity is the passage of these instructions from one generation to another. |
|                                     | <b>Remarks/Examples:</b>   |

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|                               | Integrate <a href="#">HE.7.C.1.4</a> . Describe how heredity can affect personal health.  |
| <a href="#">SC.7.L.16.2:</a>  | Determine the probabilities for genotype and phenotype combinations using Punnett Squares and pedigrees.  |
| <a href="#">SC.7.L.16.3:</a>  | Compare and contrast the general processes of sexual reproduction requiring meiosis and asexual reproduction requiring mitosis.   |
|                               | Recognize and explore the impact of biotechnology (cloning, genetic engineering, artificial selection) on the individual, society and the environment.  |
| <a href="#">SC.7.L.16.4:</a>  | <p><b>Remarks/Examples:</b><br/>Integrate <a href="#">HE.7.C.1.4</a>. Describe how heredity can affect personal health.</p>   |
| <a href="#">SC.7.L.17.1:</a>  | Explain and illustrate the roles of and relationships among producers, consumers, and decomposers in the process of energy transfer in a food web.  |
| <a href="#">SC.7.L.17.2:</a>  | Compare and contrast the relationships among organisms such as mutualism, predation, parasitism, competition, and commensalism.   |
| <a href="#">SC.7.L.17.3:</a>  | Describe and investigate various limiting factors in the local ecosystem and their impact on native populations, including food, shelter, water, space, disease, parasitism, predation, and nesting sites.  |
|                               | Describe and differentiate the layers of Earth and the interactions among them.   |
| <a href="#">SC.912.E.6.1:</a> | <p><b>Remarks/Examples:</b><br/>Recognize the importance of the study of seismic wave data and how it can be used to determine the internal structure, density variations, and dynamic processes between Earth's layers.</p>  |
|                               | Connect surface features to surface processes that are responsible for their formation.   |
| <a href="#">SC.912.E.6.2:</a> | <p><b>Remarks/Examples:</b><br/>Identify various landforms (e.g. dunes, lakes, sinkholes, aquifers) and describe how they form (erosion, physical/chemical weathering, and deposition). Explain how sea level changes over time have exposed and inundated continental shelves, created and destroyed inland seas, and shaped the surface of the Earth.</p> |



Analyze the scientific theory of plate tectonics and identify related major processes and features as a result of moving plates.

[SC.912.E.6.3:](#)

**Remarks/Examples:**

Discuss the development of plate tectonic theory, which is derived from the combination of two theories: continental drift and seafloor spreading. Compare and contrast the three primary types of plate boundaries (convergent, divergent, and transform). Explain the origin of geologic features and processes that result from plate tectonics (e.g. earthquakes, volcanoes, trenches, mid-ocean ridges, island arcs and chains, hot spots, earthquake distribution, tsunamis, mountain ranges).

Relate temperature to the average molecular kinetic energy.

[SC.912.P.10.5:](#)

**Remarks/Examples:**

Recognize that the internal energy of an object includes the energy of random motion of the object's atoms and molecules, often referred to as thermal energy.

Differentiate among the various forms of energy and recognize that they can be transformed from one form to others.

[SC.912.P.10.1:](#)

**Remarks/Examples:**

Differentiate between kinetic and potential energy. Recognize that energy cannot be created or destroyed, only transformed. Identify examples of transformation of energy: Heat to light in incandescent electric light bulbs Light to heat in laser drills Electrical to sound in radios Sound to electrical in microphones Electrical to chemical in battery rechargers Chemical to electrical in dry cells Mechanical to electrical in generators [power plants] Nuclear to heat in nuclear reactors Gravitational potential energy of a falling object is converted to kinetic energy then to heat and sound energy when the object hits the ground.

Discuss distinguishing characteristics of the domains and kingdoms of living organisms.

[SC.912.L.15.6:](#)

**Remarks/Examples:**

Annually Assessed on Biology EOC. Also assesses [SC.912.L.15.4](#) [SC.912.L.15.5](#) [SC.912.N.1.3](#) and [SC.912.N.1.6](#).

[SC.912.L.15.13:](#)

Describe the conditions required for natural selection, including: overproduction of offspring, inherited variation, and the struggle

to survive, which result in differential reproductive success.

**Remarks/Examples:**

Annually assessed on Biology EOC. Also assesses [SC.912.L.15.14](#), [SC.912.L.15.15](#), and [SC.912.N.1.3](#).

[SC.912.L.16.2:](#)

Discuss observed inheritance patterns caused by various modes of inheritance, including dominant, recessive, codominant, sex-linked, polygenic, and multiple alleles.

[SC.912.L.16.16:](#)

Describe the process of meiosis, including independent assortment and crossing over. Explain how reduction division results in the formation of haploid gametes or spores.

[SC.912.L.17.6:](#)

Compare and contrast the relationships among organisms, including predation, parasitism, competition, commensalism, and mutualism.

[SC.912.L.17.9:](#)

Use a food web to identify and distinguish producers, consumers, and decomposers. Explain the pathway of energy transfer through trophic levels and the reduction of available energy at successive trophic levels.

**Remarks/Examples:**

Annually assessed on Biology EOC. Also assesses [SC.912.E.7.1](#).

[MAFS.7.SP.2.4:](#)

Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations. *For example, decide whether the words in a chapter of a seventh-grade science book are generally longer than the words in a chapter of a fourth-grade science book.*

[MAFS.7.SP.3.5:](#)

Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.

[MAFS.8.SP.1.4:](#)

Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. *For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that*

|                                   |  |
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|                                   | <i>those who have a curfew also tend to have chores?</i>   |
| <a href="#">LAFS.7.SL.1.2:</a>    | Analyze the main ideas and supporting details presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how the ideas clarify a topic, text, or issue under study.   |
| <a href="#">LAFS.7.SL.1.3:</a>    | Delineate a speaker’s argument and specific claims, evaluating the soundness of the reasoning and the relevance and sufficiency of the evidence.   |
| <a href="#">LAFS.7.SL.2.4:</a>    | Present claims and findings, emphasizing salient points in a focused, coherent manner with pertinent descriptions, facts, details, and examples; use appropriate eye contact, adequate volume, and clear pronunciation.  |
| <a href="#">LAFS.7.SL.2.5:</a>    | Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points.  |
| <a href="#">LAFS.68.RST.1.1:</a>  | Cite specific textual evidence to support analysis of science and technical texts.   |
| <a href="#">LAFS.68.RST.1.2:</a>  | Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.   |
| <a href="#">LAFS.68.RST.1.3:</a>  | Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.  |
| <a href="#">LAFS.68.RST.2.4:</a>  | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.   |
| <a href="#">LAFS.68.RST.2.5:</a>  | Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.  |
| <a href="#">LAFS.68.RST.2.6:</a>  | Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.   |
| <a href="#">LAFS.68.RST.3.7:</a>  | Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).  |
| <a href="#">LAFS.68.RST.3.8:</a>  | Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.  |
| <a href="#">LAFS.68.RST.3.9:</a>  | Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.  |
| <a href="#">LAFS.68.WHST.1.1:</a> | Write arguments focused on <i>discipline-specific content</i> . <ul style="list-style-type: none"> <li>a. Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.</li> <li>b. Support claim(s) with logical reasoning and relevant,</li> </ul> |

|  |   |
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|  | <p>accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.</p> <ul style="list-style-type: none"> <li>c. Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.</li> <li>d. Establish and maintain a formal style.</li> <li>e. Provide a concluding statement or section that follows from and supports the argument presented.</li> </ul>   |
| <p><a href="#">LAFS.68.WHST.1.2:</a></p> | <p>Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.</p> <ul style="list-style-type: none"> <li>a. Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information into broader categories as appropriate to achieving purpose; include formatting (e.g., headings), graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension.</li> <li>b. Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.</li> <li>c. Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.</li> <li>d. Use precise language and domain-specific vocabulary to inform about or explain the topic.</li> <li>e. Establish and maintain a formal style and objective tone.</li> <li>f. Provide a concluding statement or section that follows from and supports the information or explanation presented.</li> </ul> |
| <p><a href="#">LAFS.68.WHST.2.4:</a></p> | <p>Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.</p>   |
| <p><a href="#">LAFS.68.WHST.2.5:</a></p> | <p>With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.</p>   |
| <p><a href="#">LAFS.68.WHST.2.6:</a></p> | <p>Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.</p>  |
| <p><a href="#">LAFS.68.WHST.3.7:</a></p> | <p>Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.</p>  |
| <p><a href="#">LAFS.68.WHST.3.8:</a></p> | <p>Gather relevant information from multiple print and digital</p>  |

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|  | sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. |  |
| <a href="#">LAFS.68.WHST.3.9:</a>  | Draw evidence from informational texts to support analysis reflection, and research.  |  |
| <a href="#">LAFS.68.WHST.4.10:</a>   | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.                      |  |
|  | Analyze how environmental factors affect personal health.   |  |
| <a href="#">HE.7.C.1.3:</a>  | <table border="1"> <tr> <td> <p><b>Remarks/Examples:</b><br/>Food refrigeration, appropriate home heating and cooling, air/water quality, and garbage/trash collection.</p> </td> </tr> </table>                                | <p><b>Remarks/Examples:</b><br/>Food refrigeration, appropriate home heating and cooling, air/water quality, and garbage/trash collection.</p> |
| <p><b>Remarks/Examples:</b><br/>Food refrigeration, appropriate home heating and cooling, air/water quality, and garbage/trash collection.</p> |   |  |
|  | Describe how heredity can affect personal health.   |  |
| <a href="#">HE.7.C.1.7:</a>  | <table border="1"> <tr> <td> <p><b>Remarks/Examples:</b><br/>Sickle-cell anemia, diabetes, and acne.</p> </td> </tr> </table>   | <p><b>Remarks/Examples:</b><br/>Sickle-cell anemia, diabetes, and acne.</p>  |
| <p><b>Remarks/Examples:</b><br/>Sickle-cell anemia, diabetes, and acne.</p>  |   |  |
| <a href="#">ELD.K12.ELL.1.1:</a>   | English language learners communicate for social and instructional purposes within the school setting.  |  |
| <a href="#">ELD.K12.ELL.XX.1:</a>  | English language learners communicate information, ideas and concepts necessary for academic success in the content area of Science.  |  |
| <a href="#">LAFS.7.SL.1.1a:</a>  | Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.         |  |
| <a href="#">LAFS.7.SL.1.1b:</a>  | Follow rules for collegial discussions, track progress toward specific goals and deadlines, and define individual roles as needed.  |  |
| <a href="#">LAFS.7.SL.1.1c:</a>  | Pose questions that elicit elaboration and respond to others' questions and comments with relevant observations and ideas that bring the discussion back on topic as needed.  |  |
| <a href="#">LAFS.7.SL.1.1d:</a>  | Acknowledge new information expressed by others and, when warranted, modify their own views.  |  |

## **M/J Comprehensive Science 3 (#2002100)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 2002100

**Abbreviated Title:** M/J COMP SCI 3

**Course Length:** Year (Y)

**Course Level:** 2

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 6,7,8

### **GENERAL NOTES**

Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National Science Teachers Association (NSTA) recommends that at the middle school level, all students should have multiple opportunities every week to explore science laboratory investigations (labs). School laboratory investigations are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the middle school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (NRC 2006, p. 77; NSTA, 2007).

### **Special Notes:**

#### **Instructional Practices**

Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:

1. Ensuring wide reading from complex text that varies in length.
2. Making close reading and rereading of texts central to lessons.
3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.
4. Emphasizing students supporting answers based upon evidence from the text.
5. Providing extensive research and writing opportunities (claims and evidence).
6. Integration of Florida Standards for Mathematical Practice.

Additional content that may be included in the Grade 8 NAEP Science assessment includes:

- Rocks and rock formations bear evidence of the minerals, materials, temperature/pressure conditions, and forces that created them. ([SC.4.E.6.1](#) and [SC.4.E.6.2](#))
- Earth as a whole has a magnetic field that is detectable at the surface with a compass, with north and south poles and lines of force. ([SC.912.P.10.16](#))
- The Sun is the major source of energy for phenomena on Earth's surface. ([SC.3.L.17.2](#); [SC.3.E.5.2](#); [SC.3.E.6.1](#); [SC.4.P.10.4](#); [SC.4.L.17.2](#))
- Water, which covers the majority of Earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the water cycle. ([SC.5.E.7.1](#); [SC.5.E.7.2](#); [SC.5.E.7.6](#))
- A tiny fraction of the light energy from the Sun is Earth's primary source of energy, heating Earth surfaces and providing the energy that results in wind, ocean currents, and storms. ([SC.2.E.7.2](#); [SC.3.E.6.1](#))
- Following fertilization, cell division produces a small cluster of cells that then differentiate by appearance and function to form the basic tissues of an embryo. ([SC.912.L.16.13](#))
- Characteristics of organisms are influenced by heredity and environment. ([SC.4.L.16.2](#) and [SC.4.L.16.3](#))
- Nuclear reactions take place in the Sun. ([SC.912.P.10.10](#); [SC.912.P.10.11](#))

The NAEP frameworks for Science may be accessed at <http://www.nagb.org/publications/frameworks/science-09.pdf>

### **English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Science. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/SC.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

## **COURSE STANDARDS**

### **Integrate Florida Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.

- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

| Name                        | Description   |
|-----------------------------|---|
| <a href="#">SC.8.N.1.1:</a> | Define a problem from the eighth grade curriculum using appropriate reference materials to support scientific understanding, plan and carry out scientific investigations of various types, such as systematic observations or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.   |
| <a href="#">SC.8.N.1.2:</a> | Design and conduct a study using repeated trials and replication.   |
| <a href="#">SC.8.N.1.3:</a> | Use phrases such as "results support" or "fail to support" in science, understanding that science does not offer conclusive 'proof' of a knowledge claim.   |
| <a href="#">SC.8.N.1.4:</a> | Explain how hypotheses are valuable if they lead to further investigations, even if they turn out not to be supported by the data.  |
| <a href="#">SC.8.N.1.5:</a> | Analyze the methods used to develop a scientific explanation as seen in different fields of science.  |
| <a href="#">SC.8.N.1.6:</a> | <p>Understand that scientific investigations involve the collection of relevant empirical evidence, the use of logical reasoning, and the application of imagination in devising hypotheses, predictions, explanations and models to make sense of the collected evidence.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.</p> </div> |
| <a href="#">SC.8.N.2.1:</a> | <p>Distinguish between scientific and pseudoscientific ideas.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Science is testable, pseudo-science is not science seeks falsifications, pseudo-science seeks confirmations (e.g. astrology is pseudoscience).</p> </div>   |
| <a href="#">SC.8.N.2.2:</a> | <p>Discuss what characterizes science and its methods.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b></p> </div>   |



|                             |  |
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|                             | Science is the systematic, organized inquiry that is derived from observations and experimentation that can be verified through testing to explain natural phenomena.  |
|                             | Select models useful in relating the results of their own investigations.  |
| <a href="#">SC.8.N.3.1:</a> | <p><b>Remarks/Examples:</b><br/>Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.</p>  |
| <a href="#">SC.8.N.3.2:</a> | Explain why theories may be modified but are rarely discarded.   |
| <a href="#">SC.8.N.4.2:</a> | Explain how political, social, and economic concerns can affect science, and vice versa.   |
| <a href="#">SC.8.N.4.1:</a> | Explain that science is one of the processes that can be used to inform decision making at the community, state, national, and international levels.   |
| <a href="#">SC.8.E.5.1:</a> | Recognize that there are enormous distances between objects in space and apply our knowledge of light and space travel to understand this distance.  |
| <a href="#">SC.8.E.5.2:</a> | Recognize that the universe contains many billions of galaxies and that each galaxy contains many billions of stars.   |
| <a href="#">SC.8.E.5.3:</a> | Distinguish the hierarchical relationships between planets and other astronomical bodies relative to solar system, galaxy, and universe, including distance, size, and composition.  |
| <a href="#">SC.8.E.5.4:</a> | Explore the Law of Universal Gravitation by explaining the role that gravity plays in the formation of planets, stars, and solar systems and in determining their motions.   |
| <a href="#">SC.8.E.5.5:</a> | Describe and classify specific physical properties of stars: apparent magnitude (brightness), temperature (color), size, and luminosity (absolute brightness).   |
| <a href="#">SC.8.E.5.6:</a> | <p>Create models of solar properties including: rotation, structure of the Sun, convection, sunspots, solar flares, and prominences.</p> <p><b>Remarks/Examples:</b><br/>Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics and MAFS.K12.MP.7: Look for and make use of structure.</p> |
| <a href="#">SC.8.E.5.7:</a> | Compare and contrast the properties of objects in the Solar System including the Sun, planets, and moons to those of Earth, such as gravitational force, distance from the Sun, speed, movement, temperature, and atmospheric conditions.  |
| <a href="#">SC.8.E.5.8:</a> | Compare various historical models of the Solar System, including   |

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|                                     | <p>geocentric and heliocentric.</p> <p><b>Remarks/Examples:</b><br/> Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.</p>   |
| <p><a href="#">SC.8.E.5.9:</a></p>  | <p>Explain the impact of objects in space on each other including:</p> <ol style="list-style-type: none"> <li>1. the Sun on the Earth including seasons and gravitational attraction</li> <li>2. the Moon on the Earth, including phases, tides, and eclipses, and the relative position of each body.</li> </ol>  |
| <p><a href="#">SC.8.E.5.10:</a></p> | <p>Assess how technology is essential to science for such purposes as access to outer space and other remote locations, sample collection, measurement, data collection and storage, computation, and communication of information.</p> <p><b>Remarks/Examples:</b><br/> Florida Standards Connections: MAFS.K12.MP.5: Use appropriate tools strategically; and, MAFS.K12.MP.6: Attend to precision.</p> |
| <p><a href="#">SC.8.E.5.11:</a></p> | <p>Identify and compare characteristics of the electromagnetic spectrum such as wavelength, frequency, use, and hazards and recognize its application to an understanding of planetary images and satellite photographs.</p>   |
| <p><a href="#">SC.8.E.5.12:</a></p> | <p>Summarize the effects of space exploration on the economy and culture of Florida.</p>   |
| <p><a href="#">SC.8.P.8.1:</a></p>  | <p>Explore the scientific theory of atoms (also known as atomic theory) by using models to explain the motion of particles in solids, liquids, and gases.</p>  |

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|                                    | <p><b>Remarks/Examples:</b><br/>Recognize that matter is composed of discrete units called atoms and atoms are composed of sub-atomic particles called protons, neutrons, and electrons. Solid is the state in which intermolecular attractions keep the molecules in fixed spatial relationships. Liquid is the state in which intermolecular attractions keep molecules in proximity, but not in fixed relationships. Gas is the state in which molecules are comparatively separated and intermolecular attractions have relatively little effect on their respective motions.</p> <p>Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.</p> |
| <p><a href="#">SC.8.P.8.2:</a></p> | <p>Differentiate between weight and mass recognizing that weight is the amount of gravitational pull on an object and is distinct from, though proportional to, mass.</p>  |
| <p><a href="#">SC.8.P.8.3:</a></p> | <p>Explore and describe the densities of various materials through measurement of their masses and volumes.</p> <p><b>Remarks/Examples:</b><br/>Florida Standards Connections: MAFS.K12.MP.5: Use appropriate tools strategically and, MAFS.K12.MP.6: Attend to precision.</p>   |
| <p><a href="#">SC.8.P.8.4:</a></p> | <p>Classify and compare substances on the basis of characteristic physical properties that can be demonstrated or measured; for example, density, thermal or electrical conductivity, solubility, magnetic properties, melting and boiling points, and know that these properties are independent of the amount of the sample.</p> <p><b>Remarks/Examples:</b><br/>Florida Standards Connections: MAFS.K12.MP.5: Use appropriate tools strategically and, MAFS.K12.MP.6: Attend to precision.</p>  |
| <p><a href="#">SC.8.P.8.5:</a></p> | <p>Recognize that there are a finite number of elements and that their atoms combine in a multitude of ways to produce compounds that make up all of the living and nonliving things that we encounter.</p> <p><b>Remarks/Examples:</b><br/>Demonstrate with atomic models how atoms can combine in many ways. Explain why there are many, but limited, combinations. Use models to demonstrate the conservation of mass in modeled chemical reactions.</p>  |

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| <a href="#">SC.8.P.8.6:</a>   | Recognize that elements are grouped in the periodic table according to similarities of their properties.   |
| <a href="#">SC.8.P.8.7:</a>   | Explore the scientific theory of atoms (also known as atomic theory) by recognizing that atoms are the smallest unit of an element and are composed of sub-atomic particles (electrons surrounding a nucleus containing protons and neutrons).<br><br><b>Remarks/Examples:</b><br>Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.                      |
| <a href="#">SC.8.P.8.9:</a>   | Distinguish among mixtures (including solutions) and pure substances.<br><br><b>Remarks/Examples:</b><br>Pure substances include elements and compounds. Mixtures are classified as heterogeneous (mixtures) or homogeneous (solutions). Methods for separating mixtures include: distillation, chromatography, reverse osmosis, diffusion through semi-permeable membranes. |
| <a href="#">SC.8.P.8.8:</a>   | Identify basic examples of and compare and classify the properties of compounds, including acids, bases, and salts.  |
| <a href="#">SC.8.P.9.2:</a>   | Differentiate between physical changes and chemical changes.   |
| <a href="#">SC.8.P.9.3:</a>   | Investigate and describe how temperature influences chemical changes.  |
| <a href="#">SC.8.P.9.1:</a>   | Explore the Law of Conservation of Mass by demonstrating and concluding that mass is conserved when substances undergo physical and chemical changes.  |
| <a href="#">SC.8.L.18.1:</a>  | Describe and investigate the process of photosynthesis, such as the roles of light, carbon dioxide, water and chlorophyll; production of food; release of oxygen.  |
| <a href="#">SC.8.L.18.2:</a>  | Describe and investigate how cellular respiration breaks down food to provide energy and releases carbon dioxide.  |
| <a href="#">SC.8.L.18.3:</a>  | Construct a scientific model of the carbon cycle to show how matter and energy are continuously transferred within and between organisms and their physical environment.<br><br><b>Remarks/Examples:</b><br>Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.  |
| <a href="#">SC.8.L.18.4:</a>  | Cite evidence that living systems follow the Laws of Conservation of Mass and Energy.  |
| <a href="#">MAFS.8.F.2.5:</a> | Describe qualitatively the functional relationship between two   |

quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

[MAFS.8.G.3.9:](#)

**Remarks/Examples:**

**Fluency Expectations or Examples of Culminating Standards**

When students learn to solve problems involving volumes of cones, cylinders, and spheres — together with their previous grade 7 work in angle measure, area, surface area and volume (7.G.2.4–2.6) — they will have acquired a well-developed set of geometric measurement skills. These skills, along with proportional reasoning (7.RP) and multistep numerical problem solving (7.EE.2.3), can be combined and used in flexible ways as part of modeling during high school — not to mention after high school for college and careers.

Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly.

[LAFS.8.SL.1.1:](#)

- a. Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.
- b. Follow rules for collegial discussions and decision-making, track progress toward specific goals and deadlines, and define individual roles as needed.
- c. Pose questions that connect the ideas of several speakers and respond to others' questions and comments with relevant evidence, observations, and ideas.
- d. Acknowledge new information expressed by others, and, when warranted, qualify or justify their own views in light of the evidence presented.

[LAFS.8.SL.1.2:](#)

Analyze the purpose of information presented in diverse media and formats (e.g., visually, quantitatively, orally) and evaluate the motives (e.g., social, commercial, political) behind its presentation.

[LAFS.8.SL.1.3:](#)

Delineate a speaker's argument and specific claims, evaluating the

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|-----------------------------------|---|
|                                   | soundness of the reasoning and relevance and sufficiency of the evidence and identifying when irrelevant evidence is introduced.  |
| <a href="#">LAFS.8.SL.2.4:</a>    | Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.  |
| <a href="#">LAFS.8.SL.2.5:</a>    | Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.   |
| <a href="#">LAFS.68.RST.1.1:</a>  | Cite specific textual evidence to support analysis of science and technical texts.  |
| <a href="#">LAFS.68.RST.1.2:</a>  | Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.  |
| <a href="#">LAFS.68.RST.1.3:</a>  | Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.   |
| <a href="#">LAFS.68.RST.2.4:</a>  | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.  |
| <a href="#">LAFS.68.RST.2.5:</a>  | Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.   |
| <a href="#">LAFS.68.RST.2.6:</a>  | Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.  |
| <a href="#">LAFS.68.RST.3.7:</a>  | Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).   |
| <a href="#">LAFS.68.RST.3.8:</a>  | Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.   |
| <a href="#">LAFS.68.RST.3.9:</a>  | Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.   |
| <a href="#">LAFS.68.RST.4.10:</a> | By the end of grade 8, read and comprehend science/technical texts in the grades 6–8 text complexity band independently and proficiently.   |
| <a href="#">LAFS.68.WHST.1.1:</a> | Write arguments focused on <i>discipline-specific content</i> . <ul style="list-style-type: none"> <li>a. Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.</li> <li>b. Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.</li> </ul> |

|  |   |
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|  | <ul style="list-style-type: none"> <li>c. Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.</li> <li>d. Establish and maintain a formal style.</li> <li>e. Provide a concluding statement or section that follows from and supports the argument presented.</li> </ul>   |
| <p><a href="#">LAFS.68.WHST.1.2:</a></p> | <p>Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.</p> <ul style="list-style-type: none"> <li>a. Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information into broader categories as appropriate to achieving purpose; include formatting (e.g., headings), graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension.</li> <li>b. Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.</li> <li>c. Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.</li> <li>d. Use precise language and domain-specific vocabulary to inform about or explain the topic.</li> <li>e. Establish and maintain a formal style and objective tone.</li> <li>f. Provide a concluding statement or section that follows from and supports the information or explanation presented.</li> </ul> |
| <p><a href="#">LAFS.68.WHST.2.4:</a></p> | <p>Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.</p>   |
| <p><a href="#">LAFS.68.WHST.2.5:</a></p> | <p>With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.</p>   |
| <p><a href="#">LAFS.68.WHST.2.6:</a></p> | <p>Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.</p>  |
| <p><a href="#">LAFS.68.WHST.3.7:</a></p> | <p>Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.</p>  |
| <p><a href="#">LAFS.68.WHST.3.8:</a></p> | <p>Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and</p>  |

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|                                    | conclusions of others while avoiding plagiarism and following a standard format for citation.  |
| <a href="#">LAFS.68.WHST.3.9:</a>  | Draw evidence from informational texts to support analysis reflection, and research.   |
| <a href="#">LAFS.68.WHST.4.10:</a> | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. |
| <a href="#">ELD.K12.ELL.1.1:</a>   | English language learners communicate for social and instructional purposes within the school setting.   |
| <a href="#">ELD.K12.ELL.XX.1:</a>  | English language learners communicate information, ideas and concepts necessary for academic success in the content area of Science.   |



## **M/J Comprehensive Science 3, Advanced (#2002110)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 2002110

**Abbreviated Title:** M/J COMP SCI 3 ADV

**Course Length:** Year (Y)

**Course Level:** 3

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 6,7,8

### **GENERAL NOTES**

Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National Science Teachers Association (NSTA) recommends that at the middle school level, all students should have multiple opportunities every week to explore science laboratory investigations (labs). School laboratory investigations are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the middle school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (NRC 2006, p. 77; NSTA, 2007).

### **Special Notes:**

#### **Instructional Practices**

Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:

1. Ensuring wide reading from complex text that varies in length.
2. Making close reading and rereading of texts central to lessons.
3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.
4. Emphasizing students supporting answers based upon evidence from the text.
5. Providing extensive research and writing opportunities (claims and evidence).
6. Integration of Florida Standards for Mathematical Practice.

Additional content that may be included in the Grade 8 NAEP Science assessment includes:

- Rocks and rock formations bear evidence of the minerals, materials, temperature/pressure conditions, and forces that created them. ([SC.4.E.6.1](#) and [SC.4.E.6.2](#))
- Earth as a whole has a magnetic field that is detectable at the surface with a compass, with north and south poles and lines of force. ([SC.912.P.10.16](#))
- The Sun is the major source of energy for phenomena on Earth's surface. ([SC.3.L.17.2](#); [SC.3.E.5.2](#); [SC.3.E.6.1](#); [SC.4.P.10.4](#); [SC.4.L.17.2](#))
- Water, which covers the majority of Earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the water cycle. ([SC.5.E.7.1](#); [SC.5.E.7.2](#); [SC.5.E.7.6](#))
- A tiny fraction of the light energy from the Sun is Earth's primary source of energy, heating Earth surfaces and providing the energy that results in wind, ocean currents, and storms. ([SC.2.E.7.2](#); [SC.3.E.6.1](#))
- Following fertilization, cell division produces a small cluster of cells that then differentiate by appearance and function to form the basic tissues of an embryo. ([SC.912.L.16.13](#))
- Characteristics of organisms are influenced by heredity and environment. ([SC.4.L.16.2](#) and [SC.4.L.16.3](#))
- Nuclear reactions take place in the Sun. ([SC.912.P.10.10](#); [SC.912.P.10.11](#))

The NAEP frameworks for Science may be accessed at <http://www.nagb.org/publications/frameworks/science-09.pdf>

### **English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Science. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/SC.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

## **COURSE STANDARDS**

### **Integrate Florida Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.

- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

| Name                        | Description   |
|-----------------------------|---|
| <a href="#">SC.8.N.1.1:</a> | Define a problem from the eighth grade curriculum using appropriate reference materials to support scientific understanding, plan and carry out scientific investigations of various types, such as systematic observations or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.   |
| <a href="#">SC.8.N.1.2:</a> | Design and conduct a study using repeated trials and replication.   |
| <a href="#">SC.8.N.1.3:</a> | Use phrases such as "results support" or "fail to support" in science, understanding that science does not offer conclusive 'proof' of a knowledge claim.   |
| <a href="#">SC.8.N.1.4:</a> | Explain how hypotheses are valuable if they lead to further investigations, even if they turn out not to be supported by the data.  |
| <a href="#">SC.8.N.1.5:</a> | Analyze the methods used to develop a scientific explanation as seen in different fields of science.  |
| <a href="#">SC.8.N.1.6:</a> | <p>Understand that scientific investigations involve the collection of relevant empirical evidence, the use of logical reasoning, and the application of imagination in devising hypotheses, predictions, explanations and models to make sense of the collected evidence.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.</p> </div> |
| <a href="#">SC.8.N.2.1:</a> | <p>Distinguish between scientific and pseudoscientific ideas.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Science is testable, pseudo-science is not science seeks falsifications, pseudo-science seeks confirmations (e.g. astrology is pseudoscience).</p> </div>   |
| <a href="#">SC.8.N.2.2:</a> | <p>Discuss what characterizes science and its methods.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b></p> </div>   |

|                             |  |
|-----------------------------|--|
|                             | Science is the systematic, organized inquiry that is derived from observations and experimentation that can be verified through testing to explain natural phenomena.  |
|                             | Select models useful in relating the results of their own investigations.  |
| <a href="#">SC.8.N.3.1:</a> | <p><b>Remarks/Examples:</b><br/>Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.</p>  |
| <a href="#">SC.8.N.3.2:</a> | Explain why theories may be modified but are rarely discarded.   |
| <a href="#">SC.8.N.4.2:</a> | Explain how political, social, and economic concerns can affect science, and vice versa.   |
| <a href="#">SC.8.N.4.1:</a> | Explain that science is one of the processes that can be used to inform decision making at the community, state, national, and international levels.   |
| <a href="#">SC.8.E.5.1:</a> | Recognize that there are enormous distances between objects in space and apply our knowledge of light and space travel to understand this distance.  |
| <a href="#">SC.8.E.5.2:</a> | Recognize that the universe contains many billions of galaxies and that each galaxy contains many billions of stars.   |
| <a href="#">SC.8.E.5.3:</a> | Distinguish the hierarchical relationships between planets and other astronomical bodies relative to solar system, galaxy, and universe, including distance, size, and composition.  |
| <a href="#">SC.8.E.5.4:</a> | Explore the Law of Universal Gravitation by explaining the role that gravity plays in the formation of planets, stars, and solar systems and in determining their motions.   |
| <a href="#">SC.8.E.5.5:</a> | Describe and classify specific physical properties of stars: apparent magnitude (brightness), temperature (color), size, and luminosity (absolute brightness).   |
| <a href="#">SC.8.E.5.6:</a> | <p>Create models of solar properties including: rotation, structure of the Sun, convection, sunspots, solar flares, and prominences.</p> <p><b>Remarks/Examples:</b><br/>Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics and MAFS.K12.MP.7: Look for and make use of structure.</p> |
| <a href="#">SC.8.E.5.7:</a> | Compare and contrast the properties of objects in the Solar System including the Sun, planets, and moons to those of Earth, such as gravitational force, distance from the Sun, speed, movement, temperature, and atmospheric conditions.  |
| <a href="#">SC.8.E.5.8:</a> | Compare various historical models of the Solar System, including   |

geocentric and heliocentric.

**Remarks/Examples:**

Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.

[SC.8.E.5.9:](#)

Explain the impact of objects in space on each other including:

1. the Sun on the Earth including seasons and gravitational attraction
2. the Moon on the Earth, including phases, tides, and eclipses, and the relative position of each body.

[SC.8.E.5.10:](#)

Assess how technology is essential to science for such purposes as access to outer space and other remote locations, sample collection, measurement, data collection and storage, computation, and communication of information.

**Remarks/Examples:**

Florida Standards Connections: MAFS.K12.MP.5: Use appropriate tools strategically; and, MAFS.K12.MP.6: Attend to precision.

[SC.8.E.5.11:](#)

Identify and compare characteristics of the electromagnetic spectrum such as wavelength, frequency, use, and hazards and recognize its application to an understanding of planetary images and satellite photographs.

[SC.8.E.5.12:](#)

Summarize the effects of space exploration on the economy and culture of Florida.

[SC.8.P.8.1:](#)

Explore the scientific theory of atoms (also known as atomic theory) by using models to explain the motion of particles in solids, liquids, and gases.

|                                    |   |
|------------------------------------|---|
|                                    | <p><b>Remarks/Examples:</b><br/> Recognize that matter is composed of discrete units called atoms and atoms are composed of sub-atomic particles called protons, neutrons, and electrons. Solid is the state in which intermolecular attractions keep the molecules in fixed spatial relationships. Liquid is the state in which intermolecular attractions keep molecules in proximity, but not in fixed relationships. Gas is the state in which molecules are comparatively separated and intermolecular attractions have relatively little effect on their respective motions.</p> <p>Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.</p> |
| <p><a href="#">SC.8.P.8.2:</a></p> | <p>Differentiate between weight and mass recognizing that weight is the amount of gravitational pull on an object and is distinct from, though proportional to, mass.</p>   |
| <p><a href="#">SC.8.P.8.3:</a></p> | <p>Explore and describe the densities of various materials through measurement of their masses and volumes.</p> <p><b>Remarks/Examples:</b><br/> Florida Standards Connections: MAFS.K12.MP.5: Use appropriate tools strategically and, MAFS.K12.MP.6: Attend to precision.</p>   |
| <p><a href="#">SC.8.P.8.4:</a></p> | <p>Classify and compare substances on the basis of characteristic physical properties that can be demonstrated or measured; for example, density, thermal or electrical conductivity, solubility, magnetic properties, melting and boiling points, and know that these properties are independent of the amount of the sample.</p> <p><b>Remarks/Examples:</b><br/> Florida Standards Connections: MAFS.K12.MP.5: Use appropriate tools strategically and, MAFS.K12.MP.6: Attend to precision.</p>  |
| <p><a href="#">SC.8.P.8.5:</a></p> | <p>Recognize that there are a finite number of elements and that their atoms combine in a multitude of ways to produce compounds that make up all of the living and nonliving things that we encounter.</p> <p><b>Remarks/Examples:</b><br/> Demonstrate with atomic models how atoms can combine in many ways. Explain why there are many, but limited, combinations. Use models to demonstrate the conservation of mass in modeled chemical reactions.</p>  |

|                               |  |
|-------------------------------|--|
| <a href="#">SC.8.P.8.6:</a>   | Recognize that elements are grouped in the periodic table according to similarities of their properties.   |
| <a href="#">SC.8.P.8.7:</a>   | Explore the scientific theory of atoms (also known as atomic theory) by recognizing that atoms are the smallest unit of an element and are composed of sub-atomic particles (electrons surrounding a nucleus containing protons and neutrons).<br><br><b>Remarks/Examples:</b><br>Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.                      |
| <a href="#">SC.8.P.8.9:</a>   | Distinguish among mixtures (including solutions) and pure substances.<br><br><b>Remarks/Examples:</b><br>Pure substances include elements and compounds. Mixtures are classified as heterogeneous (mixtures) or homogeneous (solutions). Methods for separating mixtures include: distillation, chromatography, reverse osmosis, diffusion through semi-permeable membranes. |
| <a href="#">SC.8.P.8.8:</a>   | Identify basic examples of and compare and classify the properties of compounds, including acids, bases, and salts.  |
| <a href="#">SC.8.P.9.2:</a>   | Differentiate between physical changes and chemical changes.   |
| <a href="#">SC.8.P.9.3:</a>   | Investigate and describe how temperature influences chemical changes.  |
| <a href="#">SC.8.P.9.1:</a>   | Explore the Law of Conservation of Mass by demonstrating and concluding that mass is conserved when substances undergo physical and chemical changes.  |
| <a href="#">SC.8.L.18.1:</a>  | Describe and investigate the process of photosynthesis, such as the roles of light, carbon dioxide, water and chlorophyll; production of food; release of oxygen.  |
| <a href="#">SC.8.L.18.2:</a>  | Describe and investigate how cellular respiration breaks down food to provide energy and releases carbon dioxide.  |
| <a href="#">SC.8.L.18.3:</a>  | Construct a scientific model of the carbon cycle to show how matter and energy are continuously transferred within and between organisms and their physical environment.<br><br><b>Remarks/Examples:</b><br>Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.  |
| <a href="#">SC.8.L.18.4:</a>  | Cite evidence that living systems follow the Laws of Conservation of Mass and Energy.  |
| <a href="#">SC.912.E.5.4:</a> | Explain the physical properties of the Sun and its dynamic nature  |

and connect them to conditions and events on Earth.

**Remarks/Examples:**

Describe the physical properties of the Sun (sunspot cycles, solar flares, prominences, layers of the Sun, coronal mass ejections, and nuclear reactions) and the impact of the Sun as the main source of external energy for the Earth.

[SC.912.P.8.1:](#)

Differentiate among the four states of matter.

**Remarks/Examples:**

Differentiate among the four states of matter (solid, liquid, gas and plasma) in terms of energy, particle motion, and phase transitions. (Note: Currently five states of matter have been identified.)

[SC.912.P.8.2:](#)

Differentiate between physical and chemical properties and physical and chemical changes of matter.

**Remarks/Examples:**

Discuss volume, compressibility, density, conductivity, malleability, reactivity, molecular composition, freezing, melting and boiling points. Describe simple laboratory techniques that can be used to separate homogeneous and heterogeneous mixtures (e.g. filtration, distillation, chromatography, evaporation).

[SC.912.P.8.4:](#)

Explore the scientific theory of atoms (also known as atomic theory) by describing the structure of atoms in terms of protons, neutrons and electrons, and differentiate among these particles in terms of their mass, electrical charges and locations within the atom.

**Remarks/Examples:**

Explain that electrons, protons and neutrons are parts of the atom and that the nuclei of atoms are composed of protons and neutrons, which experience forces of attraction and repulsion consistent with their charges and masses.

Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.

[SC.912.P.8.5:](#)

Relate properties of atoms and their position in the periodic table to the arrangement of their electrons.

**Remarks/Examples:**

Use the periodic table and electron configuration to determine



|                                |   |
|--------------------------------|---|
|                                | <p>an element's number of valence electrons and its chemical and physical properties. Explain how chemical properties depend almost entirely on the configuration of the outer electron shell.</p>  |
| <a href="#">SC.912.P.8.7:</a>  | <p>Interpret formula representations of molecules and compounds in terms of composition and structure.</p> <p><b>Remarks/Examples:</b><br/>Write chemical formulas for simple covalent (HCl, SO<sub>2</sub>, CO<sub>2</sub>, and CH<sub>4</sub>), ionic (Na<sup>+</sup> + Cl<sup>-</sup> → NaCl) and molecular (O<sub>2</sub>, H<sub>2</sub>O) compounds. Predict the formulas of ionic compounds based on the number of valence electrons and the charges on the ions.</p> |
| <a href="#">SC.912.P.8.11:</a> | <p>Relate acidity and basicity to hydronium and hydroxyl ion concentration and pH.</p> <p><b>Remarks/Examples:</b><br/>Use experimental data to illustrate and explain the pH scale to characterize acid and base solutions. Compare and contrast the strengths of various common acids and bases.</p>  |
| <a href="#">SC.912.L.18.7:</a> | Identify the reactants, products, and basic functions of photosynthesis.  |
| <a href="#">SC.912.L.18.8:</a> | Identify the reactants, products, and basic functions of aerobic and anaerobic cellular respiration.  |
| <a href="#">SC.912.L.18.9:</a> | <p>Explain the interrelated nature of photosynthesis and cellular respiration.</p> <p><b>Remarks/Examples:</b><br/>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.18.7</a> <a href="#">SC.912.L.18.8</a> <a href="#">SC.912.L.18.10</a>.</p>  |
| <a href="#">MAFS.8.F.2.5:</a>  | Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.   |
| <a href="#">MAFS.8.G.3.9:</a>  | <p>Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.</p> <p><b>Remarks/Examples:</b><br/><b>Fluency Expectations or Examples of Culminating</b></p>  |

## Standards

When students learn to solve problems involving volumes of cones, cylinders, and spheres — together with their previous grade 7 work in angle measure, area, surface area and volume (7.G.2.4–2.6) — they will have acquired a well-developed set of geometric measurement skills. These skills, along with proportional reasoning (7.RP) and multistep numerical problem solving (7.EE.2.3), can be combined and used in flexible ways as part of modeling during high school — not to mention after high school for college and careers.

### [MAFS.8.SP.1.4:](#)

Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. *For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?*

### [LAFS.8.SL.1.1:](#)

Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly.

- a. Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.
- b. Follow rules for collegial discussions and decision-making, track progress toward specific goals and deadlines, and define individual roles as needed.
- c. Pose questions that connect the ideas of several speakers and respond to others' questions and comments with relevant evidence, observations, and ideas.
- d. Acknowledge new information expressed by others, and, when warranted, qualify or justify their own views in light of the evidence presented.

### [LAFS.8.SL.1.2:](#)

Analyze the purpose of information presented in diverse media and formats (e.g., visually, quantitatively, orally) and evaluate the motives (e.g., social, commercial, political) behind its presentation.

|                                   |   |
|-----------------------------------|---|
| <a href="#">LAFS.8.SL.1.3:</a>    | Delineate a speaker’s argument and specific claims, evaluating the soundness of the reasoning and relevance and sufficiency of the evidence and identifying when irrelevant evidence is introduced.   |
| <a href="#">LAFS.8.SL.2.4:</a>    | Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.  |
| <a href="#">LAFS.8.SL.2.5:</a>    | Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.   |
| <a href="#">LAFS.68.RST.1.1:</a>  | Cite specific textual evidence to support analysis of science and technical texts.  |
| <a href="#">LAFS.68.RST.1.2:</a>  | Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.  |
| <a href="#">LAFS.68.RST.1.3:</a>  | Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.   |
| <a href="#">LAFS.68.RST.2.4:</a>  | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.  |
| <a href="#">LAFS.68.RST.2.5:</a>  | Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.   |
| <a href="#">LAFS.68.RST.2.6:</a>  | Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.  |
| <a href="#">LAFS.68.RST.3.7:</a>  | Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).   |
| <a href="#">LAFS.68.RST.3.8:</a>  | Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.   |
| <a href="#">LAFS.68.RST.3.9:</a>  | Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.   |
| <a href="#">LAFS.68.RST.4.10:</a> | By the end of grade 8, read and comprehend science/technical texts in the grades 6–8 text complexity band independently and proficiently.   |
|                                   | Write arguments focused on <i>discipline-specific content</i> .   |
| <a href="#">LAFS.68.WHST.1.1:</a> | <ol style="list-style-type: none"> <li>a. Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.</li> <li>b. Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an</li> </ol> |

- understanding of the topic or text, using credible sources.
- c. Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.
- d. Establish and maintain a formal style.
- e. Provide a concluding statement or section that follows from and supports the argument presented.

[LAFS.68.WHST.1.2:](#)

Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

- a. Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information into broader categories as appropriate to achieving purpose; include formatting (e.g., headings), graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension.
- b. Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.
- c. Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.
- d. Use precise language and domain-specific vocabulary to inform about or explain the topic.
- e. Establish and maintain a formal style and objective tone.
- f. Provide a concluding statement or section that follows from and supports the information or explanation presented.

[LAFS.68.WHST.2.4:](#)

Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

[LAFS.68.WHST.2.5:](#)

With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.

[LAFS.68.WHST.2.6:](#)

Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.

[LAFS.68.WHST.3.7:](#)

Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.

[LAFS.68.WHST.3.8:](#)

Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and

accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

[LAFS.68.WHST.3.9:](#)

Draw evidence from informational texts to support analysis reflection, and research.

[LAFS.68.WHST.4.10:](#)

Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.XX.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Science.

## **M/J Earth/Space Science (#2001010)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 2001010

**Abbreviated Title:** M/J EARTH/SPA SCI

**Course Length:** Year (Y)

**Course Level:** 2

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 6,7,8

### **GENERAL NOTES**

Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National Science Teachers Association (NSTA) recommends that at the middle school level, all students should have multiple opportunities every week to explore science laboratory investigations (labs). School laboratory investigations are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the middle school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (NRC 2006, p. 77; NSTA, 2007).

### **Special Notes:**

#### **Instructional Practices**

Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:

1. Ensuring wide reading from complex text that varies in length.
2. Making close reading and rereading of texts central to lessons.
3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.
4. Emphasizing students supporting answers based upon evidence from the text.
5. Providing extensive research and writing opportunities (claims and evidence).

#### **English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts

for academic success in the content area of Science. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/SC.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

## COURSE STANDARDS

### Integrate Florida Standards for Mathematical Practice (MP) as applicable.

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

Use grade appropriate Nature of Science benchmarks (i.e. if this course is offered to seventh grade students, then the SC.7.N benchmarks should be integrated into the course content, and SC.6.N and SC.8.N benchmarks should be omitted from the seventh grade course).

| Name  | Description  |
|---|--|
| <p><a href="#">SC.6.N.1.2:</a></p> <p><a href="#">SC.6.N.1.1:</a></p> | <p>Explain why scientific investigations should be replicable.</p> <p>Define a problem from the sixth grade curriculum, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigation of various types, such as systematic observations or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>Remarks/Examples:</b><br/>           Florida Standards Connections: <a href="#">LAFS.68.RST.1.3</a>. Follow</p> </div> |

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|                             | precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.   |
| <a href="#">SC.6.N.1.3:</a> | <p>Explain the difference between an experiment and other types of scientific investigation, and explain the relative benefits and limitations of each.</p> <p><b>Remarks/Examples:</b><br/> Explain that an investigation is observing or studying the natural world, without interference or manipulation, and an experiment is an investigation that involves variables (independent/manipulated and dependent/ outcome) and establishes cause-and-effect relationships (Schwartz, 2007).</p> |
| <a href="#">SC.6.N.1.4:</a> | Discuss, compare, and negotiate methods used, results obtained, and explanations among groups of students conducting the same investigation.   |
| <a href="#">SC.6.N.1.5:</a> | <p>Recognize that science involves creativity, not just in designing experiments, but also in creating explanations that fit evidence.</p> <p><b>Remarks/Examples:</b><br/> Florida Standards Connections: <a href="#">LAFS.68.RST.3.7</a><br/> <a href="#">LAFS.68.WHST.1.2</a> and, <a href="#">LAFS.68.WHST.3.9</a>.</p>  |
| <a href="#">SC.6.N.2.1:</a> | <p>Distinguish science from other activities involving thought.</p> <p><b>Remarks/Examples:</b><br/> Thought refers to any mental or intellectual activity involving an individual's subjective consciousness. Science is a systematic process that pursues, builds and organizes knowledge in the form of testable explanations and predictions about the natural world.</p>  |
| <a href="#">SC.6.N.2.2:</a> | Explain that scientific knowledge is durable because it is open to change as new evidence or interpretations are encountered.  |
| <a href="#">SC.6.N.2.3:</a> | Recognize that scientists who make contributions to scientific knowledge come from all kinds of backgrounds and possess varied talents, interests, and goals.  |
| <a href="#">SC.6.N.3.3:</a> | Give several examples of scientific laws.  |
| <a href="#">SC.6.N.3.4:</a> | <p>Identify the role of models in the context of the sixth grade science benchmarks.</p> <p><b>Remarks/Examples:</b><br/> Florida Standards Connections: MAFS.K12.MP.4: Model</p>  |



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|                             | with mathematics.   |
| <a href="#">SC.6.N.3.1:</a> | Recognize and explain that a scientific theory is a well-supported and widely accepted explanation of nature and is not simply a claim posed by an individual. Thus, the use of the term theory in science is very different than how it is used in everyday life.  |
| <a href="#">SC.6.N.3.2:</a> | Recognize and explain that a scientific law is a description of a specific relationship under given conditions in the natural world. Thus, scientific laws are different from societal laws.  |
| <a href="#">SC.6.E.6.1:</a> | Describe and give examples of ways in which Earth's surface is built up and torn down by physical and chemical weathering, erosion, and deposition.   |
| <a href="#">SC.6.E.6.2:</a> | Recognize that there are a variety of different landforms on Earth's surface such as coastlines, dunes, rivers, mountains, glaciers, deltas, and lakes and relate these landforms as they apply to Florida.<br><br><b>Remarks/Examples:</b><br>Annually assessed on Grade 5 Science FCAT 2.0. Also assesses <a href="#">SC.4.E.6.1</a> .  |
| <a href="#">SC.6.E.7.1:</a> | Differentiate among radiation, conduction, and convection, the three mechanisms by which heat is transferred through Earth's system.  |
| <a href="#">SC.6.E.7.2:</a> | Investigate and apply how the cycling of water between the atmosphere and hydrosphere has an effect on weather patterns and climate.<br><br><b>Remarks/Examples:</b><br>Florida Standards Connections: MAFS.K12.MP.7: Look for and make use of structure.   |
| <a href="#">SC.6.E.7.3:</a> | Describe how global patterns such as the jet stream and ocean currents influence local weather in measurable terms such as temperature, air pressure, wind direction and speed, and humidity and precipitation.<br><br><b>Remarks/Examples:</b><br><br>Florida Standards Connections: MAFS.K12.MP.5: Use appropriate tools strategically MAFS.K12.MP.6: Attend to precision and, MAFS.K12.MP.7: Look for and make use of structure. |
| <a href="#">SC.6.E.7.4:</a> | Differentiate and show interactions among the geosphere, hydrosphere, cryosphere, atmosphere, and biosphere.  |

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| <p><a href="#">SC.6.E.7.5:</a></p> | <p>Explain how energy provided by the sun influences global patterns of atmospheric movement and the temperature differences between air, water, and land.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/> Florida Standards Connections: MAFS.K12.MP.7: Look for and make use of structure.</p> </div>  |
| <p><a href="#">SC.6.E.7.6:</a></p> | <p>Differentiate between weather and climate.</p>   |
| <p><a href="#">SC.6.E.7.7:</a></p> | <p>Investigate how natural disasters have affected human life in Florida.</p>   |
| <p><a href="#">SC.6.E.7.8:</a></p> | <p>Describe ways human beings protect themselves from hazardous weather and sun exposure.</p>   |
| <p><a href="#">SC.6.E.7.9:</a></p> | <p>Describe how the composition and structure of the atmosphere protects life and insulates the planet.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/> Florida Standards Connections: MAFS.K12.MP.7: Look for and make use of structure.</p> </div>   |
| <p><a href="#">SC.7.N.1.2:</a></p> | <p>Differentiate replication (by others) from repetition (multiple trials).</p>   |
| <p><a href="#">SC.7.N.1.1:</a></p> | <p>Define a problem from the seventh grade curriculum, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigation of various types, such as systematic observations or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/> Florida Standards Connections: LAFS.68.RST.1.3. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.</p> </div> |
| <p><a href="#">SC.7.N.1.3:</a></p> | <p>Distinguish between an experiment (which must involve the identification and control of variables) and other forms of scientific investigation and explain that not all scientific knowledge is derived from experimentation.</p>  |
| <p><a href="#">SC.7.N.1.4:</a></p> | <p>Identify test variables (independent variables) and outcome variables (dependent variables) in an experiment.</p>  |
| <p><a href="#">SC.7.N.1.5:</a></p> | <p>Describe the methods used in the pursuit of a scientific explanation as seen in different fields of science such as biology, geology, and physics.</p>   |

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| <a href="#">SC.7.N.1.6:</a> | Explain that empirical evidence is the cumulative body of observations of a natural phenomenon on which scientific explanations are based.   |
| <a href="#">SC.7.N.1.7:</a> | Explain that scientific knowledge is the result of a great deal of debate and confirmation within the science community.   |
| <a href="#">SC.7.N.2.1:</a> | Identify an instance from the history of science in which scientific knowledge has changed when new evidence or new interpretations are encountered.   |
| <a href="#">SC.7.N.3.2:</a> | Identify the benefits and limitations of the use of scientific models.<br><div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>Remarks/Examples:</b><br/> Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.</p> </div>   |
| <a href="#">SC.7.N.3.1:</a> | Recognize and explain the difference between theories and laws and give several examples of scientific theories and the evidence that supports them.   |
| <a href="#">SC.7.E.6.1:</a> | Describe the layers of the solid Earth, including the lithosphere, the hot convecting mantle, and the dense metallic liquid and solid cores.   |
| <a href="#">SC.7.E.6.2:</a> | Identify the patterns within the rock cycle and relate them to surface events (weathering and erosion) and sub-surface events (plate tectonics and mountain building).<br><div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>Remarks/Examples:</b><br/> Florida Standards Connections: MAFS.K12.MP.7: Look for and make use of structure.</p> </div> |
| <a href="#">SC.7.E.6.3:</a> | Identify current methods for measuring the age of Earth and its parts, including the law of superposition and radioactive dating.  |
| <a href="#">SC.7.E.6.4:</a> | Explain and give examples of how physical evidence supports scientific theories that Earth has evolved over geologic time due to natural processes.  |
| <a href="#">SC.7.E.6.5:</a> | Explore the scientific theory of plate tectonics by describing how the movement of Earth's crustal plates causes both slow and rapid changes in Earth's surface, including volcanic eruptions, earthquakes, and mountain building.   |
| <a href="#">SC.7.E.6.6:</a> | Identify the impact that humans have had on Earth, such as deforestation, urbanization, desertification, erosion, air and water quality, changing the flow of water.   |
| <a href="#">SC.7.E.6.7:</a> | Recognize that heat flow and movement of material within Earth causes earthquakes and volcanic eruptions, and creates mountains and ocean basins.  |

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| <a href="#">SC.8.N.1.1:</a> | <p>Define a problem from the eighth grade curriculum using appropriate reference materials to support scientific understanding, plan and carry out scientific investigations of various types, such as systematic observations or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.</p>   |
| <a href="#">SC.8.N.1.2:</a> | <p>Design and conduct a study using repeated trials and replication.</p>   |
| <a href="#">SC.8.N.1.3:</a> | <p>Use phrases such as "results support" or "fail to support" in science, understanding that science does not offer conclusive 'proof' of a knowledge claim.</p>   |
| <a href="#">SC.8.N.1.4:</a> | <p>Explain how hypotheses are valuable if they lead to further investigations, even if they turn out not to be supported by the data.</p>  |
| <a href="#">SC.8.N.1.5:</a> | <p>Analyze the methods used to develop a scientific explanation as seen in different fields of science.</p>  |
| <a href="#">SC.8.N.1.6:</a> | <p>Understand that scientific investigations involve the collection of relevant empirical evidence, the use of logical reasoning, and the application of imagination in devising hypotheses, predictions, explanations and models to make sense of the collected evidence.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.</p> </div> |
| <a href="#">SC.8.N.2.1:</a> | <p>Distinguish between scientific and pseudoscientific ideas.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Science is testable, pseudo-science is not science seeks falsifications, pseudo-science seeks confirmations (e.g. astrology is pseudoscience).</p> </div>  |
| <a href="#">SC.8.N.2.2:</a> | <p>Discuss what characterizes science and its methods.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Science is the systematic, organized inquiry that is derived from observations and experimentation that can be verified through testing to explain natural phenomena.</p> </div>  |
| <a href="#">SC.8.N.3.1:</a> | <p>Select models useful in relating the results of their own investigations.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.</p> </div>  |

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| <a href="#">SC.8.N.3.2:</a> | Explain why theories may be modified but are rarely discarded.  |
| <a href="#">SC.8.N.4.2:</a> | Explain how political, social, and economic concerns can affect science, and vice versa.  |
| <a href="#">SC.8.N.4.1:</a> | Explain that science is one of the processes that can be used to inform decision making at the community, state, national, and international levels.  |
| <a href="#">SC.8.E.5.1:</a> | Recognize that there are enormous distances between objects in space and apply our knowledge of light and space travel to understand this distance.   |
| <a href="#">SC.8.E.5.2:</a> | Recognize that the universe contains many billions of galaxies and that each galaxy contains many billions of stars.  |
| <a href="#">SC.8.E.5.3:</a> | Distinguish the hierarchical relationships between planets and other astronomical bodies relative to solar system, galaxy, and universe, including distance, size, and composition.   |
| <a href="#">SC.8.E.5.4:</a> | Explore the Law of Universal Gravitation by explaining the role that gravity plays in the formation of planets, stars, and solar systems and in determining their motions.  |
| <a href="#">SC.8.E.5.5:</a> | Describe and classify specific physical properties of stars: apparent magnitude (brightness), temperature (color), size, and luminosity (absolute brightness).  |
| <a href="#">SC.8.E.5.6:</a> | <p>Create models of solar properties including: rotation, structure of the Sun, convection, sunspots, solar flares, and prominences.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/> Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics and MAFS.K12.MP.7: Look for and make use of structure.</p> </div> |
| <a href="#">SC.8.E.5.7:</a> | Compare and contrast the properties of objects in the Solar System including the Sun, planets, and moons to those of Earth, such as gravitational force, distance from the Sun, speed, movement, temperature, and atmospheric conditions.   |
| <a href="#">SC.8.E.5.8:</a> | <p>Compare various historical models of the Solar System, including geocentric and heliocentric.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/> Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.</p> </div>   |
| <a href="#">SC.8.E.5.9:</a> | <p>Explain the impact of objects in space on each other including:</p> <ol style="list-style-type: none"> <li>1. the Sun on the Earth including seasons and gravitational attraction</li> <li>2. the Moon on the Earth, including phases, tides, and</li> </ol>   |

eclipses, and the relative position of each body.

[SC.8.E.5.10:](#)

Assess how technology is essential to science for such purposes as access to outer space and other remote locations, sample collection, measurement, data collection and storage, computation, and communication of information.

**Remarks/Examples:**

Florida Standards Connections: MAFS.K12.MP.5: Use appropriate tools strategically; and, MAFS.K12.MP.6: Attend to precision.

[SC.8.E.5.11:](#)

Identify and compare characteristics of the electromagnetic spectrum such as wavelength, frequency, use, and hazards and recognize its application to an understanding of planetary images and satellite photographs.

[SC.8.E.5.12:](#)

Summarize the effects of space exploration on the economy and culture of Florida.

[MAFS.6.EE.3.9:](#)

Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. *For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation  $d = 65t$  to represent the relationship between distance and time.*

[MAFS.6.SP.2.4:](#)

Display numerical data in plots on a number line, including dot plots, histograms, and box plots.

[MAFS.6.SP.2.5:](#)

Summarize numerical data sets in relation to their context, such as by:

- a. Reporting the number of observations.
- b. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.
- c. Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.
- d. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which

the data were gathered.

[LAFS.6.SL.1.1:](#)

Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly.

- a. Come to discussions prepared, having read or studied required material; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.
- b. Follow rules for collegial discussions, set specific goals and deadlines, and define individual roles as needed.
- c. Pose and respond to specific questions with elaboration and detail by making comments that contribute to the topic, text, or issue under discussion.
- d. Review the key ideas expressed and demonstrate understanding of multiple perspectives through reflection and paraphrasing.

[LAFS.6.SL.1.2:](#)

Interpret information presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how it contributes to a topic, text, or issue under study.

[LAFS.6.SL.1.3:](#)

Delineate a speaker's argument and specific claims, distinguishing claims that are supported by reasons and evidence from claims that are not.

[LAFS.6.SL.2.4:](#)

Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume, and clear pronunciation.

[LAFS.6.SL.2.5:](#)

Include multimedia components (e.g., graphics, images, music, sound) and visual displays in presentations to clarify information.

[LAFS.68.RST.1.1:](#)

Cite specific textual evidence to support analysis of science and technical texts.

[LAFS.68.RST.1.2:](#)

Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.

[LAFS.68.RST.1.3:](#)

Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

[LAFS.68.RST.2.4:](#)

Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.

[LAFS.68.RST.2.5:](#)

Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an

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|                                   | understanding of the topic.  |
| <a href="#">LAFS.68.RST.2.6:</a>  | Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.   |
| <a href="#">LAFS.68.RST.3.7:</a>  | Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).  |
| <a href="#">LAFS.68.RST.3.8:</a>  | Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.  |
| <a href="#">LAFS.68.RST.3.9:</a>  | Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.  |
| <a href="#">LAFS.68.WHST.1.1:</a> | <p>Write arguments focused on <i>discipline-specific content</i>.</p> <ol style="list-style-type: none"> <li>a. Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.</li> <li>b. Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.</li> <li>c. Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.</li> <li>d. Establish and maintain a formal style.</li> <li>e. Provide a concluding statement or section that follows from and supports the argument presented.</li> </ol>   |
| <a href="#">LAFS.68.WHST.1.2:</a> | <p>Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.</p> <ol style="list-style-type: none"> <li>a. Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information into broader categories as appropriate to achieving purpose; include formatting (e.g., headings), graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension.</li> <li>b. Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.</li> <li>c. Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.</li> <li>d. Use precise language and domain-specific vocabulary to inform about or explain the topic.</li> <li>e. Establish and maintain a formal style and objective tone.</li> <li>f. Provide a concluding statement or section that follows from and supports the information or explanation</li> </ol> |



presented.

[LAFS.68.WHST.2.4:](#)

Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

[LAFS.68.WHST.2.5:](#)

With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.

[LAFS.68.WHST.2.6:](#)

Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.

[LAFS.68.WHST.3.7:](#)

Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.

[LAFS.68.WHST.3.8:](#)

Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

[LAFS.68.WHST.3.9:](#)

Draw evidence from informational texts to support analysis, reflection, and research.

[LAFS.68.WHST.4.10:](#)

Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

[HE.6.C.1.3:](#)

Identify environmental factors that affect personal health.

**Remarks/Examples:**

Air and water quality, availability of sidewalks, contaminated food, and road hazards.

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.XX.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Science.

## **M/J Earth/Space Science, Advanced (#2001020)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 2001020

**Abbreviated Title:** M/J EARTH/SPA SCI ADV

**Course Length:** Year (Y)

**Course Level:** 3

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 6,7,8

### **GENERAL NOTES**

Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National Science Teachers Association (NSTA) recommends that at the middle school level, all students should have multiple opportunities every week to explore science laboratory investigations (labs). School laboratory investigations are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the middle school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (NRC 2006, p. 77; NSTA, 2007).

### **Special Notes:**

#### **Instructional Practices**

Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:

1. Ensuring wide reading from complex text that varies in length.
2. Making close reading and rereading of texts central to lessons.
3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.
4. Emphasizing students supporting answers based upon evidence from the text.
5. Providing extensive research and writing opportunities (claims and evidence).

### **English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Science. For the given level of English

language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/SC.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

## COURSE STANDARDS

### Integrate Florida Standards for Mathematical Practice (MP) as applicable.

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

Use grade appropriate Nature of Science benchmarks (i.e. if this course is offered to seventh grade students, then the SC.7.N benchmarks should be integrated into the course content, and SC.6.N and SC.8.N benchmarks should be omitted from the seventh grade course).

| Name                        | Description   |
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| <a href="#">SC.6.E.6.1:</a> | Describe and give examples of ways in which Earth's surface is built up and torn down by physical and chemical weathering, erosion, and deposition.   |
| <a href="#">SC.6.E.6.2:</a> | Recognize that there are a variety of different landforms on Earth's surface such as coastlines, dunes, rivers, mountains, glaciers, deltas, and lakes and relate these landforms as they apply to Florida. <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>Remarks/Examples:</b><br/>Annually assessed on Grade 5 Science FCAT 2.0. Also assesses <a href="#">SC.4.E.6.1</a>.</p> </div> |

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| <a href="#">SC.6.E.7.1:</a> | Differentiate among radiation, conduction, and convection, the three mechanisms by which heat is transferred through Earth's system.  |
| <a href="#">SC.6.E.7.2:</a> | Investigate and apply how the cycling of water between the atmosphere and hydrosphere has an effect on weather patterns and climate.<br><br><b>Remarks/Examples:</b><br>Florida Standards Connections: MAFS.K12.MP.7: Look for and make use of structure.   |
| <a href="#">SC.6.E.7.3:</a> | Describe how global patterns such as the jet stream and ocean currents influence local weather in measurable terms such as temperature, air pressure, wind direction and speed, and humidity and precipitation.<br><br><b>Remarks/Examples:</b><br>Florida Standards Connections: MAFS.K12.MP.5: Use appropriate tools strategically MAFS.K12.MP.6: Attend to precision and, MAFS.K12.MP.7: Look for and make use of structure. |
| <a href="#">SC.6.E.7.4:</a> | Differentiate and show interactions among the geosphere, hydrosphere, cryosphere, atmosphere, and biosphere.  |
| <a href="#">SC.6.E.7.5:</a> | Explain how energy provided by the sun influences global patterns of atmospheric movement and the temperature differences between air, water, and land.<br><br><b>Remarks/Examples:</b><br>Florida Standards Connections: MAFS.K12.MP.7: Look for and make use of structure.  |
| <a href="#">SC.6.E.7.6:</a> | Differentiate between weather and climate.  |
| <a href="#">SC.6.E.7.7:</a> | Investigate how natural disasters have affected human life in Florida.  |
| <a href="#">SC.6.E.7.8:</a> | Describe ways human beings protect themselves from hazardous weather and sun exposure.  |
| <a href="#">SC.6.E.7.9:</a> | Describe how the composition and structure of the atmosphere protects life and insulates the planet.<br><br><b>Remarks/Examples:</b><br>Florida Standards Connections: MAFS.K12.MP.7: Look for and make use of structure.   |
| <a href="#">SC.7.N.1.2:</a> | Differentiate replication (by others) from repetition (multiple   |

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|                             | trials).   |
| <a href="#">SC.7.N.1.1:</a> | <p>Define a problem from the seventh grade curriculum, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigation of various types, such as systematic observations or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b></p> <p>Florida Standards Connections: LAFS.68.RST.1.3. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.</p> </div> |
| <a href="#">SC.7.N.1.3:</a> | Distinguish between an experiment (which must involve the identification and control of variables) and other forms of scientific investigation and explain that not all scientific knowledge is derived from experimentation.  |
| <a href="#">SC.7.N.1.4:</a> | Identify test variables (independent variables) and outcome variables (dependent variables) in an experiment.  |
| <a href="#">SC.7.N.1.5:</a> | Describe the methods used in the pursuit of a scientific explanation as seen in different fields of science such as biology, geology, and physics.   |
| <a href="#">SC.7.N.1.6:</a> | Explain that empirical evidence is the cumulative body of observations of a natural phenomenon on which scientific explanations are based.   |
| <a href="#">SC.7.N.1.7:</a> | Explain that scientific knowledge is the result of a great deal of debate and confirmation within the science community.   |
| <a href="#">SC.7.N.2.1:</a> | Identify an instance from the history of science in which scientific knowledge has changed when new evidence or new interpretations are encountered.   |
| <a href="#">SC.7.N.3.2:</a> | <p>Identify the benefits and limitations of the use of scientific models.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b></p> <p>Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.</p> </div>   |
| <a href="#">SC.7.N.3.1:</a> | Recognize and explain the difference between theories and laws and give several examples of scientific theories and the evidence that supports them.   |
| <a href="#">SC.7.E.6.1:</a> | Describe the layers of the solid Earth, including the lithosphere, the hot convecting mantle, and the dense metallic liquid and solid  |

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|                             | cores.  |
| <a href="#">SC.7.E.6.2:</a> | Identify the patterns within the rock cycle and relate them to surface events (weathering and erosion) and sub-surface events (plate tectonics and mountain building).<br><br><b>Remarks/Examples:</b><br>Florida Standards Connections: MAFS.K12.MP.7: Look for and make use of structure.   |
| <a href="#">SC.7.E.6.3:</a> | Identify current methods for measuring the age of Earth and its parts, including the law of superposition and radioactive dating.   |
| <a href="#">SC.7.E.6.4:</a> | Explain and give examples of how physical evidence supports scientific theories that Earth has evolved over geologic time due to natural processes.   |
| <a href="#">SC.7.E.6.5:</a> | Explore the scientific theory of plate tectonics by describing how the movement of Earth's crustal plates causes both slow and rapid changes in Earth's surface, including volcanic eruptions, earthquakes, and mountain building.  |
| <a href="#">SC.7.E.6.6:</a> | Identify the impact that humans have had on Earth, such as deforestation, urbanization, desertification, erosion, air and water quality, changing the flow of water.  |
| <a href="#">SC.7.E.6.7:</a> | Recognize that heat flow and movement of material within Earth causes earthquakes and volcanic eruptions, and creates mountains and ocean basins.   |
| <a href="#">SC.8.N.1.1:</a> | Define a problem from the eighth grade curriculum using appropriate reference materials to support scientific understanding, plan and carry out scientific investigations of various types, such as systematic observations or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions. |
| <a href="#">SC.8.N.1.2:</a> | Design and conduct a study using repeated trials and replication.   |
| <a href="#">SC.8.N.1.3:</a> | Use phrases such as "results support" or "fail to support" in science, understanding that science does not offer conclusive 'proof' of a knowledge claim.   |
| <a href="#">SC.8.N.1.4:</a> | Explain how hypotheses are valuable if they lead to further investigations, even if they turn out not to be supported by the data.  |
| <a href="#">SC.8.N.1.5:</a> | Analyze the methods used to develop a scientific explanation as seen in different fields of science.  |
| <a href="#">SC.8.N.1.6:</a> | Understand that scientific investigations involve the collection of relevant empirical evidence, the use of logical reasoning, and the application of imagination in devising hypotheses, predictions, explanations and models to make sense of the collected evidence.   |

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|                             | <p><b>Remarks/Examples:</b><br/>Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.</p>  |
| <a href="#">SC.8.N.2.1:</a> | <p>Distinguish between scientific and pseudoscientific ideas.</p> <p><b>Remarks/Examples:</b><br/>Science is testable, pseudo-science is not science seeks falsifications, pseudo-science seeks confirmations (e.g. astrology is pseudoscience).</p>                 |
| <a href="#">SC.8.N.2.2:</a> | <p>Discuss what characterizes science and its methods.</p> <p><b>Remarks/Examples:</b><br/>Science is the systematic, organized inquiry that is derived from observations and experimentation that can be verified through testing to explain natural phenomena.</p> |
| <a href="#">SC.8.N.3.1:</a> | <p>Select models useful in relating the results of their own investigations.</p> <p><b>Remarks/Examples:</b><br/>Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.</p>   |
| <a href="#">SC.8.N.3.2:</a> | <p>Explain why theories may be modified but are rarely discarded.</p>  |
| <a href="#">SC.8.N.4.2:</a> | <p>Explain how political, social, and economic concerns can affect science, and vice versa.</p>  |
| <a href="#">SC.8.N.4.1:</a> | <p>Explain that science is one of the processes that can be used to inform decision making at the community, state, national, and international levels.</p>  |
| <a href="#">SC.8.E.5.1:</a> | <p>Recognize that there are enormous distances between objects in space and apply our knowledge of light and space travel to understand this distance.</p>   |
| <a href="#">SC.8.E.5.2:</a> | <p>Recognize that the universe contains many billions of galaxies and that each galaxy contains many billions of stars.</p>  |
| <a href="#">SC.8.E.5.3:</a> | <p>Distinguish the hierarchical relationships between planets and other astronomical bodies relative to solar system, galaxy, and universe, including distance, size, and composition.</p>   |
| <a href="#">SC.8.E.5.4:</a> | <p>Explore the Law of Universal Gravitation by explaining the role that gravity plays in the formation of planets, stars, and solar systems and in determining their motions.</p>  |
| <a href="#">SC.8.E.5.5:</a> | <p>Describe and classify specific physical properties of stars: apparent magnitude (brightness), temperature (color), size, and luminosity (absolute brightness).</p>  |

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| <p><a href="#">SC.8.E.5.6:</a></p>   | <p>Create models of solar properties including: rotation, structure of the Sun, convection, sunspots, solar flares, and prominences.</p> <p><b>Remarks/Examples:</b><br/>Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics and MAFS.K12.MP.7: Look for and make use of structure.</p>  |
| <p><a href="#">SC.8.E.5.7:</a></p>   | <p>Compare and contrast the properties of objects in the Solar System including the Sun, planets, and moons to those of Earth, such as gravitational force, distance from the Sun, speed, movement, temperature, and atmospheric conditions.</p>  |
| <p><a href="#">SC.8.E.5.8:</a></p>   | <p>Compare various historical models of the Solar System, including geocentric and heliocentric.</p> <p><b>Remarks/Examples:</b><br/>Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.</p>  |
| <p><a href="#">SC.8.E.5.9:</a></p>   | <p>Explain the impact of objects in space on each other including:</p> <ol style="list-style-type: none"> <li>1. the Sun on the Earth including seasons and gravitational attraction</li> <li>2. the Moon on the Earth, including phases, tides, and eclipses, and the relative position of each body.</li> </ol>   |
| <p><a href="#">SC.8.E.5.10:</a></p>  | <p>Assess how technology is essential to science for such purposes as access to outer space and other remote locations, sample collection, measurement, data collection and storage, computation, and communication of information.</p> <p><b>Remarks/Examples:</b><br/>Florida Standards Connections: MAFS.K12.MP.5: Use appropriate tools strategically; and, MAFS.K12.MP.6: Attend to precision.</p> |
| <p><a href="#">SC.8.E.5.11:</a></p>  | <p>Identify and compare characteristics of the electromagnetic spectrum such as wavelength, frequency, use, and hazards and recognize its application to an understanding of planetary images and satellite photographs.</p>  |
| <p><a href="#">SC.8.E.5.12:</a></p>  | <p>Summarize the effects of space exploration on the economy and culture of Florida.</p>  |
| <p><a href="#">SC.912.E.5.4:</a></p> | <p>Explain the physical properties of the Sun and its dynamic nature and connect them to conditions and events on Earth.</p> <p><b>Remarks/Examples:</b></p>  |



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|                                      | <p>Describe the physical properties of the Sun (sunspot cycles, solar flares, prominences, layers of the Sun, coronal mass ejections, and nuclear reactions) and the impact of the Sun as the main source of external energy for the Earth.</p>  |
| <p><a href="#">SC.912.E.6.1:</a></p> | <p>Describe and differentiate the layers of Earth and the interactions among them.</p> <p><b>Remarks/Examples:</b><br/>Recognize the importance of the study of seismic wave data and how it can be used to determine the internal structure, density variations, and dynamic processes between Earth's layers.</p>  |
| <p><a href="#">SC.912.E.6.2:</a></p> | <p>Connect surface features to surface processes that are responsible for their formation.</p> <p><b>Remarks/Examples:</b><br/>Identify various landforms (e.g. dunes, lakes, sinkholes, aquifers) and describe how they form (erosion, physical/chemical weathering, and deposition). Explain how sea level changes over time have exposed and inundated continental shelves, created and destroyed inland seas, and shaped the surface of the Earth.</p>   |
| <p><a href="#">SC.912.E.6.3:</a></p> | <p>Analyze the scientific theory of plate tectonics and identify related major processes and features as a result of moving plates.</p> <p><b>Remarks/Examples:</b><br/>Discuss the development of plate tectonic theory, which is derived from the combination of two theories: continental drift and seafloor spreading. Compare and contrast the three primary types of plate boundaries (convergent, divergent, and transform). Explain the origin of geologic features and processes that result from plate tectonics (e.g. earthquakes, volcanoes, trenches, mid-ocean ridges, island arcs and chains, hot spots, earthquake distribution, tsunamis, mountain ranges).</p> |
| <p><a href="#">SC.912.E.7.3:</a></p> | <p>Differentiate and describe the various interactions among Earth systems, including: atmosphere, hydrosphere, cryosphere, geosphere, and biosphere.</p> <p><b>Remarks/Examples:</b><br/>Interactions include transfer of energy (biogeochemical cycles, water cycle, ground and surface waters,</p>  |

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|                                | <p>photosynthesis, radiation, plate tectonics, conduction, and convection), storms, winds, waves, erosion, currents, deforestation and wildfires, hurricanes, tsunamis, volcanoes.</p>   |
| <a href="#">SC.912.E.7.5:</a>  | <p>Predict future weather conditions based on present observations and conceptual models and recognize limitations and uncertainties of such predictions.</p> <p><b>Remarks/Examples:</b><br/>Use models, weather maps and other tools to predict weather conditions and differentiate between accuracy of short-range and long-range weather forecasts.</p>   |
| <a href="#">SC.912.E.7.6:</a>  | <p>Relate the formation of severe weather to the various physical factors.</p> <p><b>Remarks/Examples:</b><br/>Identify the causes of severe weather. Compare and contrast physical factors that affect the formation of severe weather events (e.g. hurricanes, tornados, flash floods, thunderstorms, and drought).</p>  |
| <a href="#">HE.6.C.1.3:</a>    | <p>Identify environmental factors that affect personal health.</p> <p><b>Remarks/Examples:</b><br/>Some examples may include air quality, availability of sidewalks, contaminated food, and road hazards.</p>  |
| <a href="#">MAFS.6.EE.3.9:</a> | <p>Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. <i>For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation <math>d = 65t</math> to represent the relationship between distance and time.</i></p> |
| <a href="#">MAFS.6.SP.2.4:</a> | <p>Display numerical data in plots on a number line, including dot plots, histograms, and box plots.</p>   |
| <a href="#">MAFS.6.SP.2.5:</a> | <p>Summarize numerical data sets in relation to their context, such as by:</p> <ol style="list-style-type: none"> <li>Reporting the number of observations.</li> <li>Describing the nature of the attribute under investigation, including how it was measured and its units of</li> </ol>   |

- measurement.
- c. Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.
- d. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.

[MAFS.7.SP.2.4:](#)

Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations. *For example, decide whether the words in a chapter of a seventh-grade science book are generally longer than the words in a chapter of a fourth-grade science book.*

[MAFS.7.SP.3.5:](#)

Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.

[LAFS.7.SL.1.1:](#)

- Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 7 topics, texts, and issues, building on others' ideas and expressing their own clearly.
- a. Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.
  - b. Follow rules for collegial discussions, track progress toward specific goals and deadlines, and define individual roles as needed.
  - c. Pose questions that elicit elaboration and respond to others' questions and comments with relevant observations and ideas that bring the discussion back on topic as needed.
  - d. Acknowledge new information expressed by others and, when warranted, modify their own views.

[LAFS.7.SL.1.2:](#)

Analyze the main ideas and supporting details presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how the ideas clarify a topic, text, or issue under study.

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| <a href="#">LAFS.7.SL.1.3:</a>    | Delineate a speaker’s argument and specific claims, evaluating the soundness of the reasoning and the relevance and sufficiency of the evidence.   |
| <a href="#">LAFS.7.SL.2.4:</a>    | Present claims and findings, emphasizing salient points in a focused, coherent manner with pertinent descriptions, facts, details, and examples; use appropriate eye contact, adequate volume, and clear pronunciation.  |
| <a href="#">LAFS.7.SL.2.5:</a>    | Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points.  |
| <a href="#">LAFS.68.RST.1.1:</a>  | Cite specific textual evidence to support analysis of science and technical texts.   |
| <a href="#">LAFS.68.RST.1.2:</a>  | Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.   |
| <a href="#">LAFS.68.RST.1.3:</a>  | Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.  |
| <a href="#">LAFS.68.RST.2.4:</a>  | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.   |
| <a href="#">LAFS.68.RST.2.5:</a>  | Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.  |
| <a href="#">LAFS.68.RST.2.6:</a>  | Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.   |
| <a href="#">LAFS.68.RST.3.7:</a>  | Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).  |
| <a href="#">LAFS.68.RST.3.8:</a>  | Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.  |
| <a href="#">LAFS.68.RST.3.9:</a>  | Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.  |
| <a href="#">LAFS.68.WHST.1.1:</a> | <p>Write arguments focused on <i>discipline-specific content</i>.</p> <ol style="list-style-type: none"> <li>a. Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.</li> <li>b. Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.</li> <li>c. Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.</li> </ol> |

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|                                   | <ul style="list-style-type: none"> <li>d. Establish and maintain a formal style.</li> <li>e. Provide a concluding statement or section that follows from and supports the argument presented.</li> </ul>  |
|                                   | <p>Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.</p> <ul style="list-style-type: none"> <li>a. Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information into broader categories as appropriate to achieving purpose; include formatting (e.g., headings), graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension.</li> <li>b. Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.</li> <li>c. Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.</li> <li>d. Use precise language and domain-specific vocabulary to inform about or explain the topic.</li> <li>e. Establish and maintain a formal style and objective tone.</li> <li>f. Provide a concluding statement or section that follows from and supports the information or explanation presented.</li> </ul> |
| <a href="#">LAFS.68.WHST.1.2:</a> |   |
| <a href="#">LAFS.68.WHST.2.4:</a> | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.  |
| <a href="#">LAFS.68.WHST.2.5:</a> | With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.  |
| <a href="#">LAFS.68.WHST.2.6:</a> | Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.   |
| <a href="#">LAFS.68.WHST.3.7:</a> | Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.   |
| <a href="#">LAFS.68.WHST.3.8:</a> | Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.   |
| <a href="#">LAFS.68.WHST.3.9:</a> | Draw evidence from informational texts to support analysis  |

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|                                    | reflection, and research.   |
| <a href="#">LAFS.68.WHST.4.10:</a> | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.  |
| <a href="#">HE.6.C.1.3:</a>        | Identify environmental factors that affect personal health.<br><div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>Remarks/Examples:</b><br/>Air and water quality, availability of sidewalks, contaminated food, and road hazards.</p> </div> |
| <a href="#">ELD.K12.ELL.1.1:</a>   | English language learners communicate for social and instructional purposes within the school setting.  |
| <a href="#">ELD.K12.ELL.XX.1:</a>  | English language learners communicate information, ideas and concepts necessary for academic success in the content area of Science.  |

## **M/J Life Science (#2000010)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 2000010

**Abbreviated Title:** M/J LIF SCI

**Course Length:** Year (Y)

**Course Level:** 2

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 6,7,8

### **GENERAL NOTES**

Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National Science Teachers Association (NSTA) recommends that at the middle school level, all students should have multiple opportunities every week to explore science laboratory investigations (labs). School laboratory investigations are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the middle school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (NRC 2006, p. 77; NSTA, 2007).

### **Special Notes:**

#### **Instructional Practices**

Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:

1. Ensuring wide reading from complex text that varies in length.
2. Making close reading and rereading of texts central to lessons.
3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.
4. Emphasizing students supporting answers based upon evidence from the text.
5. Providing extensive research and writing opportunities (claims and evidence).

#### **English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that

allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Science. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/SC.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

## COURSE STANDARDS

### **Integrate Florida Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

**Use grade appropriate Nature of Science benchmarks** (i.e. if this course is offered to sixth grade students, then the SC.6.N benchmarks should be integrated into the sixth grade course, and SC.7.N and SC.8.N benchmarks should be omitted from the sixth grade course).

| Name                        | Description  |
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| <a href="#">SC.6.N.1.2:</a> | Explain why scientific investigations should be replicable.  |
| <a href="#">SC.6.N.1.1:</a> | Define a problem from the sixth grade curriculum, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigation of various types, such as systematic observations or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions. |
|                             | <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b></p> </div>  |



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|                                    | <p>Florida Standards Connections: <a href="#">LAFS.68.RST.1.3</a>. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.</p>   |
| <p><a href="#">SC.6.N.1.3:</a></p> | <p>Explain the difference between an experiment and other types of scientific investigation, and explain the relative benefits and limitations of each.</p> <p><b>Remarks/Examples:</b><br/> Explain that an investigation is observing or studying the natural world, without interference or manipulation, and an experiment is an investigation that involves variables (independent/manipulated and dependent/ outcome) and establishes cause-and-effect relationships (Schwartz, 2007).</p> |
| <p><a href="#">SC.6.N.1.4:</a></p> | <p>Discuss, compare, and negotiate methods used, results obtained, and explanations among groups of students conducting the same investigation.</p>  |
| <p><a href="#">SC.6.N.1.5:</a></p> | <p>Recognize that science involves creativity, not just in designing experiments, but also in creating explanations that fit evidence.</p> <p><b>Remarks/Examples:</b><br/> Florida Standards Connections: <a href="#">LAFS.68.RST.3.7</a><br/> <a href="#">LAFS.68.WHST.1.2</a> and, <a href="#">LAFS.68.WHST.3.9</a>.</p>  |
| <p><a href="#">SC.6.N.2.1:</a></p> | <p>Distinguish science from other activities involving thought.</p> <p><b>Remarks/Examples:</b><br/> Thought refers to any mental or intellectual activity involving an individual's subjective consciousness. Science is a systematic process that pursues, builds and organizes knowledge in the form of testable explanations and predictions about the natural world.</p>  |
| <p><a href="#">SC.6.N.2.2:</a></p> | <p>Explain that scientific knowledge is durable because it is open to change as new evidence or interpretations are encountered.</p>   |
| <p><a href="#">SC.6.N.2.3:</a></p> | <p>Recognize that scientists who make contributions to scientific knowledge come from all kinds of backgrounds and possess varied talents, interests, and goals.</p>   |
| <p><a href="#">SC.6.N.3.3:</a></p> | <p>Give several examples of scientific laws.</p>   |
| <p><a href="#">SC.6.N.3.4:</a></p> | <p>Identify the role of models in the context of the sixth grade science benchmarks.</p> <p><b>Remarks/Examples:</b></p>   |

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|                              | Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.  |
| <a href="#">SC.6.N.3.1:</a>  | Recognize and explain that a scientific theory is a well-supported and widely accepted explanation of nature and is not simply a claim posed by an individual. Thus, the use of the term theory in science is very different than how it is used in everyday life.           |
| <a href="#">SC.6.N.3.2:</a>  | Recognize and explain that a scientific law is a description of a specific relationship under given conditions in the natural world. Thus, scientific laws are different from societal laws.   |
| <a href="#">SC.6.L.14.1:</a> | Describe and identify patterns in the hierarchical organization of organisms from atoms to molecules and cells to tissues to organs to organ systems to organisms.   |
|                              | <b>Remarks/Examples:</b><br>Florida Standards Connections: MAFS.K12.MP.7: Look for and make use of structure.  |
| <a href="#">SC.6.L.14.2:</a> | Investigate and explain the components of the scientific theory of cells (cell theory): all organisms are composed of cells (single-celled or multi-cellular), all cells come from pre-existing cells, and cells are the basic unit of life.                                 |
| <a href="#">SC.6.L.14.3:</a> | Recognize and explore how cells of all organisms undergo similar processes to maintain homeostasis, including extracting energy from food, getting rid of waste, and reproducing.  |
| <a href="#">SC.6.L.14.4:</a> | Compare and contrast the structure and function of major organelles of plant and animal cells, including cell wall, cell membrane, nucleus, cytoplasm, chloroplasts, mitochondria, and vacuoles.   |
|                              | <b>Remarks/Examples:</b><br>Florida Standards Connections: MAFS.K12.MP.7: Look for and make use of structure.  |
| <a href="#">SC.6.L.14.5:</a> | Identify and investigate the general functions of the major systems of the human body (digestive, respiratory, circulatory, reproductive, excretory, immune, nervous, and musculoskeletal) and describe ways these systems interact with each other to maintain homeostasis. |
| <a href="#">SC.6.L.14.6:</a> | Compare and contrast types of infectious agents that may infect the human body, including viruses, bacteria, fungi, and parasites.   |
|                              | <b>Remarks/Examples:</b><br>Integrate <a href="#">HE.6.C.1.8</a> . Explain how body systems are impacted by hereditary factors and infectious agents.  |

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| <a href="#">SC.6.L.15.1:</a> | Analyze and describe how and why organisms are classified according to shared characteristics with emphasis on the Linnaean system combined with the concept of Domains.   |
| <a href="#">SC.7.N.1.2:</a>  | Differentiate replication (by others) from repetition (multiple trials).   |
| <a href="#">SC.7.N.1.1:</a>  | <p>Define a problem from the seventh grade curriculum, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigation of various types, such as systematic observations or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b></p> <p>Florida Standards Connections: LAFS.68.RST.1.3. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.</p> </div> |
| <a href="#">SC.7.N.1.3:</a>  | Distinguish between an experiment (which must involve the identification and control of variables) and other forms of scientific investigation and explain that not all scientific knowledge is derived from experimentation.  |
| <a href="#">SC.7.N.1.4:</a>  | Identify test variables (independent variables) and outcome variables (dependent variables) in an experiment.  |
| <a href="#">SC.7.N.1.5:</a>  | Describe the methods used in the pursuit of a scientific explanation as seen in different fields of science such as biology, geology, and physics.   |
| <a href="#">SC.7.N.1.6:</a>  | Explain that empirical evidence is the cumulative body of observations of a natural phenomenon on which scientific explanations are based.   |
| <a href="#">SC.7.N.1.7:</a>  | Explain that scientific knowledge is the result of a great deal of debate and confirmation within the science community.   |
| <a href="#">SC.7.N.2.1:</a>  | Identify an instance from the history of science in which scientific knowledge has changed when new evidence or new interpretations are encountered.   |
| <a href="#">SC.7.N.3.2:</a>  | <p>Identify the benefits and limitations of the use of scientific models.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b></p> <p>Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.</p> </div>   |
| <a href="#">SC.7.N.3.1:</a>  | Recognize and explain the difference between theories and laws   |

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|                              | and give several examples of scientific theories and the evidence that supports them.  |
| <a href="#">SC.7.L.15.1:</a> | Recognize that fossil evidence is consistent with the scientific theory of evolution that living things evolved from earlier species.  |
| <a href="#">SC.7.L.15.2:</a> | Explore the scientific theory of evolution by recognizing and explaining ways in which genetic variation and environmental factors contribute to evolution by natural selection and diversity of organisms.  |
| <a href="#">SC.7.L.15.3:</a> | Explore the scientific theory of evolution by relating how the inability of a species to adapt within a changing environment may contribute to the extinction of that species.   |
| <a href="#">SC.7.L.16.1:</a> | Understand and explain that every organism requires a set of instructions that specifies its traits, that this hereditary information (DNA) contains genes located in the chromosomes of each cell, and that heredity is the passage of these instructions from one generation to another. |
|                              | <p><b>Remarks/Examples:</b><br/>Integrate <a href="#">HE.7.C.1.4</a>. Describe how heredity can affect personal health.</p>  |
| <a href="#">SC.7.L.16.2:</a> | Determine the probabilities for genotype and phenotype combinations using Punnett Squares and pedigrees.   |
| <a href="#">SC.7.L.16.3:</a> | Compare and contrast the general processes of sexual reproduction requiring meiosis and asexual reproduction requiring mitosis.  |
| <a href="#">SC.7.L.16.4:</a> | Recognize and explore the impact of biotechnology (cloning, genetic engineering, artificial selection) on the individual, society and the environment.   |
|                              | <p><b>Remarks/Examples:</b><br/>Integrate <a href="#">HE.7.C.1.4</a>. Describe how heredity can affect personal health.</p>  |
| <a href="#">SC.7.L.17.1:</a> | Explain and illustrate the roles of and relationships among producers, consumers, and decomposers in the process of energy transfer in a food web.   |
| <a href="#">SC.7.L.17.2:</a> | Compare and contrast the relationships among organisms such as mutualism, predation, parasitism, competition, and commensalism.  |
| <a href="#">SC.7.L.17.3:</a> | Describe and investigate various limiting factors in the local ecosystem and their impact on native populations, including food, shelter, water, space, disease, parasitism, predation, and nesting sites.   |
| <a href="#">SC.8.N.1.1:</a>  | Define a problem from the eighth grade curriculum using  |

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|                             | appropriate reference materials to support scientific understanding, plan and carry out scientific investigations of various types, such as systematic observations or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.                                |
| <a href="#">SC.8.N.1.2:</a> | Design and conduct a study using repeated trials and replication.  |
| <a href="#">SC.8.N.1.3:</a> | Use phrases such as "results support" or "fail to support" in science, understanding that science does not offer conclusive 'proof' of a knowledge claim.  |
| <a href="#">SC.8.N.1.4:</a> | Explain how hypotheses are valuable if they lead to further investigations, even if they turn out not to be supported by the data.   |
| <a href="#">SC.8.N.1.5:</a> | Analyze the methods used to develop a scientific explanation as seen in different fields of science.   |
| <a href="#">SC.8.N.1.6:</a> | Understand that scientific investigations involve the collection of relevant empirical evidence, the use of logical reasoning, and the application of imagination in devising hypotheses, predictions, explanations and models to make sense of the collected evidence.<br><br><b>Remarks/Examples:</b><br>Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics. |
| <a href="#">SC.8.N.2.1:</a> | Distinguish between scientific and pseudoscientific ideas.<br><br><b>Remarks/Examples:</b><br>Science is testable, pseudo-science is not science seeks falsifications, pseudo-science seeks confirmations (e.g. astrology is pseudoscience).   |
| <a href="#">SC.8.N.2.2:</a> | Discuss what characterizes science and its methods.<br><br><b>Remarks/Examples:</b><br>Science is the systematic, organized inquiry that is derived from observations and experimentation that can be verified through testing to explain natural phenomena.   |
| <a href="#">SC.8.N.3.1:</a> | Select models useful in relating the results of their own investigations.<br><br><b>Remarks/Examples:</b><br>Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.   |
| <a href="#">SC.8.N.3.2:</a> | Explain why theories may be modified but are rarely discarded.   |

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| <a href="#">SC.8.N.4.2:</a>    | Explain how political, social, and economic concerns can affect science, and vice versa.  |
| <a href="#">SC.8.N.4.1:</a>    | Explain that science is one of the processes that can be used to inform decision making at the community, state, national, and international levels.  |
| <a href="#">SC.8.L.18.1:</a>   | Describe and investigate the process of photosynthesis, such as the roles of light, carbon dioxide, water and chlorophyll; production of food; release of oxygen.   |
| <a href="#">SC.8.L.18.2:</a>   | Describe and investigate how cellular respiration breaks down food to provide energy and releases carbon dioxide.   |
| <a href="#">SC.8.L.18.3:</a>   | Construct a scientific model of the carbon cycle to show how matter and energy are continuously transferred within and between organisms and their physical environment.<br><br><b>Remarks/Examples:</b><br>Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.   |
| <a href="#">SC.8.L.18.4:</a>   | Cite evidence that living systems follow the Laws of Conservation of Mass and Energy.   |
| <a href="#">MAFS.6.EE.3.9:</a> | Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. <i>For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation <math>d = 65t</math> to represent the relationship between distance and time.</i> |
| <a href="#">MAFS.6.SP.2.4:</a> | Display numerical data in plots on a number line, including dot plots, histograms, and box plots.   |
| <a href="#">MAFS.6.SP.2.5:</a> | Summarize numerical data sets in relation to their context, such as by: <ul style="list-style-type: none"> <li>a. Reporting the number of observations.</li> <li>b. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.</li> <li>c. Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.</li> </ul>                        |

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|                                   | d. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.   |
| <a href="#">LAFS.6.SL.1.2:</a>    | Interpret information presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how it contributes to a topic, text, or issue under study.  |
| <a href="#">LAFS.6.SL.1.3:</a>    | Delineate a speaker’s argument and specific claims, distinguishing claims that are supported by reasons and evidence from claims that are not.  |
| <a href="#">LAFS.6.SL.2.4:</a>    | Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume, and clear pronunciation.                     |
| <a href="#">LAFS.6.SL.2.5:</a>    | Include multimedia components (e.g., graphics, images, music, sound) and visual displays in presentations to clarify information.   |
| <a href="#">LAFS.68.RST.1.1:</a>  | Cite specific textual evidence to support analysis of science and technical texts.  |
| <a href="#">LAFS.68.RST.1.2:</a>  | Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.  |
| <a href="#">LAFS.68.RST.1.3:</a>  | Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.   |
| <a href="#">LAFS.68.RST.2.4:</a>  | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.  |
| <a href="#">LAFS.68.RST.2.5:</a>  | Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.   |
| <a href="#">LAFS.68.RST.2.6:</a>  | Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.  |
| <a href="#">LAFS.68.RST.3.7:</a>  | Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).   |
| <a href="#">LAFS.68.RST.3.8:</a>  | Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.   |
| <a href="#">LAFS.68.RST.3.9:</a>  | Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.   |
| <a href="#">LAFS.68.WHST.1.1:</a> | Write arguments focused on <i>discipline-specific content</i> . <ul style="list-style-type: none"> <li>a. Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims,</li> </ul> |

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|  | <p>and organize the reasons and evidence logically.</p> <ul style="list-style-type: none"> <li>b. Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.</li> <li>c. Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.</li> <li>d. Establish and maintain a formal style.</li> <li>e. Provide a concluding statement or section that follows from and supports the argument presented.</li> </ul> |
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|  | <p>Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.</p> <ul style="list-style-type: none"> <li>a. Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information into broader categories as appropriate to achieving purpose; include formatting (e.g., headings), graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension.</li> <li>b. Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.</li> <li>c. Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.</li> <li>d. Use precise language and domain-specific vocabulary to inform about or explain the topic.</li> <li>e. Establish and maintain a formal style and objective tone.</li> <li>f. Provide a concluding statement or section that follows from and supports the information or explanation presented.</li> </ul> |
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[LAFS.68.WHST.1.2:](#)

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| <a href="#"><u>LAFS.68.WHST.2.4:</u></a> | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. |
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| <a href="#"><u>LAFS.68.WHST.2.5:</u></a> | With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed. |
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| <a href="#"><u>LAFS.68.WHST.2.6:</u></a> | Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently. |
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| <a href="#"><u>LAFS.68.WHST.3.7:</u></a> | Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for |
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|                                    | multiple avenues of exploration.  |
| <a href="#">LAFS.68.WHST.3.8:</a>  | Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.   |
| <a href="#">LAFS.68.WHST.3.9:</a>  | Draw evidence from informational texts to support analysis, reflection, and research.   |
| <a href="#">LAFS.68.WHST.4.10:</a> | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.  |
| <a href="#">HE.6.C.1.8:</a>        | Examine the likelihood of injury or illness if engaging in unhealthy/risky behaviors.<br><br><b>Remarks/Examples:</b><br>Obesity related to poor nutrition and inactivity, cancer and chronic lung disease related to tobacco use, injuries caused from failure to use seat restraint, and sexually transmitted diseases caused by sexual activity. |
| <a href="#">HE.7.C.1.3:</a>        | Analyze how environmental factors affect personal health.<br><br><b>Remarks/Examples:</b><br>Food refrigeration, appropriate home heating and cooling, air/water quality, and garbage/trash collection.   |
| <a href="#">HE.7.C.1.7:</a>        | Describe how heredity can affect personal health.<br><br><b>Remarks/Examples:</b><br>Sickle-cell anemia, diabetes, and acne.  |
| <a href="#">ELD.K12.ELL.1.1:</a>   | English language learners communicate for social and instructional purposes within the school setting.  |
| <a href="#">ELD.K12.ELL.XX.1:</a>  | English language learners communicate information, ideas and concepts necessary for academic success in the content area of Science.  |
| <a href="#">LAFS.6.SL.1.1a:</a>    | Come to discussions prepared, having read or studied required material; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.   |
| <a href="#">LAFS.6.SL.1.1b:</a>    | Follow rules for collegial discussions, set specific goals and deadlines, and define individual roles as needed.  |
| <a href="#">LAFS.6.SL.1.1c:</a>    | Pose and respond to specific questions with elaboration and detail by making comments that contribute to the topic, text, or issue under discussion.  |

[LAFS.6.SL.1.1d:](#)

Review the key ideas expressed and demonstrate understanding of multiple perspectives through reflection and paraphrasing.

## **Anatomy and Physiology (#2000350)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 2000350

**Abbreviated Title:** ANAT PHYSIO

**Number of Credits:** One credit (1)

**Course Length:** Year (Y)

**Course Type:** Core

**Course Level:** 2

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 9,10,11,12

### **GENERAL NOTES**

Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National Science Teachers Association (NSTA) recommends that at the high school level, all students should be in the science lab or field, collecting data every week. School laboratory investigations (labs) are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the high school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (National Research Council, 2006, p.77; NSTA, 2007).

### **Special Notes:**

#### **Instructional Practices**

Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:

1. Ensuring wide reading from complex text that varies in length.
2. Making close reading and rereading of texts central to lessons.
3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.
4. Emphasizing students supporting answers based upon evidence from the text.
5. Providing extensive research and writing opportunities (claims and evidence).

### English Language Development ELD Standards Special Notes Section:

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Science. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/SC.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

### COURSE STANDARDS

#### Integrate Standards for Mathematical Practice (MP) as applicable.

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MACC.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

| Name                          | Description  |
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| <a href="#">SC.912.N.1.1:</a> | Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following: <ol style="list-style-type: none"><li>1. <b>Pose questions about the natural world,</b> (Articulate the purpose of the investigation and identify the relevant scientific concepts).</li><li>2. <b>Conduct systematic observations,</b> (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).</li></ol> |

3. **Examine books and other sources of information to see what is already known,**
4. **Review what is known in light of empirical evidence,** (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).
5. **Plan investigations,** (Design and evaluate a scientific investigation).
6. **Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),** (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).
7. **Pose answers, explanations, or descriptions of events,**
8. **Generate explanations that explicate or describe natural phenomena (inferences),**
9. **Use appropriate evidence and reasoning to justify these explanations to others,**
10. **Communicate results of scientific investigations, and**
11. **Evaluate the merits of the explanations produced by others.**

**Remarks/Examples:**

Florida Standards Connections for 6-12 Literacy in Science

For Students in Grades 9-10

LAFS.910.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.

LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into

words.

LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.

For Students in Grades 11-12

LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks analyze the specific results based on explanations in the text.

LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.

Florida Standards Connections for Mathematical Practices

MAFS.K12.MP.1: Make sense of problems and persevere in solving them.

MAFS.K12.MP.2: Reason abstractly and quantitatively.

MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]

MAFS.K12.MP.4: Model with mathematics.

MAFS.K12.MP.5: Use appropriate tools strategically.

MAFS.K12.MP.6: Attend to precision.

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|                                 | <p>MAFS.K12.MP.7: Look for and make use of structure.<br/> MAFS.K12.MP.8: Look for and express regularity in repeated reasoning.</p>   |
| <a href="#">SC.912.N.1.2:</a>   | <p>Describe and explain what characterizes science and its methods.</p> <p><b>Remarks/Examples:</b><br/> Science is characterized by empirical observations, testable questions, formation of hypotheses, and experimentation that results in stable and replicable results, logical reasoning, and coherent theoretical constructs.</p> <p>Florida Standards Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others.</p> |
| <a href="#">SC.912.L.14.20:</a> | <p>Identify the major muscles of the human on a model or diagram.</p> <p><b>Remarks/Examples:</b><br/> Refer to MAFS.K12.MP.4: Model with mathematics.</p>   |
| <a href="#">SC.912.L.14.12:</a> | Describe the anatomy and histology of bone tissue.   |
| <a href="#">SC.912.L.14.13:</a> | Distinguish between bones of the axial skeleton and the appendicular skeleton.   |
| <a href="#">SC.912.L.14.11:</a> | Classify and state the defining characteristics of epithelial tissue, connective tissue, muscle tissue, and nervous tissue.  |
| <a href="#">SC.912.L.14.14:</a> | Identify the major bones of the axial and appendicular skeleton.   |
| <a href="#">SC.912.L.14.16:</a> | Describe the anatomy and histology, including ultrastructure, of muscle tissue.  |
| <a href="#">SC.912.L.14.17:</a> | List the steps involved in the sliding filament of muscle contraction.   |
| <a href="#">SC.912.L.14.18:</a> | Describe signal transmission across a myoneural junction.  |
| <a href="#">SC.912.L.14.21:</a> | Describe the anatomy, histology, and physiology of the central and peripheral nervous systems and name the major divisions of the nervous system.  |
| <a href="#">SC.912.L.14.23:</a> | Identify the parts of a reflex arc.  |
| <a href="#">SC.912.L.14.24:</a> | Identify the general parts of a synapse and describe the physiology of signal transmission across a synapse.   |
| <a href="#">SC.912.L.14.25:</a> | Identify the major parts of a cross section through the spinal cord.   |
| <a href="#">SC.912.L.14.26:</a> | Identify the major parts of the brain on diagrams or models.   |

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|                                 | <p><b>Remarks/Examples:</b></p> <p>Annually Assessed on Biology EOC.</p> <p>Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.</p>                           |
| <a href="#">SC.912.L.14.28:</a> | Identify the major functions of the spinal cord.  |
| <a href="#">SC.912.L.14.29:</a> | Define the terms endocrine and exocrine.  |
| <a href="#">SC.912.L.14.30:</a> | Compare endocrine and neural controls of physiology.  |
| <a href="#">SC.912.L.14.32:</a> | Describe the anatomy and physiology of the endocrine system.  |
| <a href="#">SC.912.L.14.33:</a> | Describe the basic anatomy and physiology of the reproductive system.   |
| <a href="#">SC.912.L.14.34:</a> | Describe the composition and physiology of blood, including that of the plasma and the formed elements.   |
| <a href="#">SC.912.L.14.35:</a> | Describe the steps in hemostasis, including the mechanism of coagulation. Include the basis for blood typing and transfusion reactions.   |
| <a href="#">SC.912.L.14.36:</a> | Describe the factors affecting blood flow through the cardiovascular system.  |
| <a href="#">SC.912.L.14.38:</a> | Describe normal heart sounds and what they mean.  |
| <a href="#">SC.912.L.14.39:</a> | Describe hypertension and some of the factors that produce it.  |
| <a href="#">SC.912.L.14.41:</a> | Describe fetal circulation and changes that occur to the circulatory system at birth.   |
| <a href="#">SC.912.L.14.42:</a> | Describe the anatomy and the physiology of the lymph system.  |
| <a href="#">SC.912.L.14.44:</a> | Describe the physiology of the respiratory system including the mechanisms of ventilation, gas exchange, gas transport and the mechanisms that control the rate of ventilation. |
| <a href="#">SC.912.L.14.46:</a> | Describe the physiology of the digestive system, including mechanical digestion, chemical digestion, absorption and the neural and hormonal mechanisms of control.              |
| <a href="#">SC.912.L.14.47:</a> | Describe the physiology of urine formation by the kidney.   |
| <a href="#">SC.912.L.14.49:</a> | Identify the major functions associated with the sympathetic and parasympathetic nervous systems.   |
| <a href="#">SC.912.L.14.50:</a> | Describe the structure of vertebrate sensory organs. Relate structure to function in vertebrate sensory systems.  |
| <a href="#">SC.912.L.14.51:</a> | Describe the function of the vertebrate integumentary system.   |
| <a href="#">SC.912.L.14.52:</a> | Explain the basic functions of the human immune system, including specific and nonspecific immune response, vaccines, and antibiotics.  |
|                                 | <p><b>Remarks/Examples:</b></p>   |



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|   | <p>Annually Assessed on Biology EOC. Also assesses <a href="#">SC.912.L.14.6</a> <a href="#">HE.912.C.1.7</a> and <a href="#">HE.912.C.1.5</a>.</p>  |
| <p><a href="#">SC.912.L.16.8:</a></p>     | <p>Explain the relationship between mutation, cell cycle, and uncontrolled cell growth potentially resulting in cancer.</p> <p><b>Remarks/Examples:</b></p> <p>Integrate <a href="#">HE.912.C.1.7</a>. Analyze how heredity and family history can impact personal health.</p>   |
| <p><a href="#">SC.912.L.18.1:</a></p>     | <p>Describe the basic molecular structures and primary functions of the four major categories of biological macromolecules.</p> <p><b>Remarks/Examples:</b></p> <p>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.18.11</a>.</p>   |
| <p><a href="#">SC.912.L.18.11:</a></p>    | <p>Explain the role of enzymes as catalysts that lower the activation energy of biochemical reactions. Identify factors, such as pH and temperature, and their effect on enzyme activity.</p>  |
| <p><a href="#">MAFS.912.N-Q.1.1:</a></p>  | <p>Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. ★</p>   |
| <p><a href="#">MAFS.912.N-Q.1.3:</a></p>  | <p>Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. ★</p>   |
| <p><a href="#">MAFS.912.F-IF.2.4:</a></p> | <p>For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. <i>Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</i> ★</p>   |
| <p><a href="#">MAFS.912.F-IF.3.7:</a></p> | <p>Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★</p> <ol style="list-style-type: none"> <li>Graph linear and quadratic functions and show intercepts, maxima, and minima.</li> <li>Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.</li> <li>Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end</li> </ol> |

- behavior.
- d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.
- e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.

Represent data with plots on the real number line (dot plots, histograms, and box plots). ★

[MAFS.912.S-ID.1.1:](#)

**Remarks/Examples:**

In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.

Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. ★

[MAFS.912.S-ID.1.2:](#)

**Remarks/Examples:**

In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.

Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). ★

[MAFS.912.S-ID.1.3:](#)

**Remarks/Examples:**

In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.

Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. ★

[MAFS.912.S-ID.1.4:](#)

[MAFS.912.S-ID.2.5:](#)

Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. ★

[MAFS.912.S-ID.2.6:](#)

Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. ★

- a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear, and exponential models.*
- b. Informally assess the fit of a function by plotting and analyzing residuals.
- c. Fit a linear function for a scatter plot that suggests a linear association.

**Remarks/Examples:**

Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals.

[LAFS.1112.SL.1.1:](#)

Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.

- a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.
- b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.
- c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.
- d. Respond thoughtfully to diverse perspectives;

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|                                    | synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task.  |
| <a href="#">LAFS.1112.SL.1.2:</a>  | Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.   |
| <a href="#">LAFS.1112.SL.1.3:</a>  | Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used.   |
| <a href="#">LAFS.1112.SL.2.4:</a>  | Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. |
| <a href="#">LAFS.1112.SL.2.5:</a>  | Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.   |
| <a href="#">LAFS.1112.RST.1.1:</a> | Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.  |
| <a href="#">LAFS.1112.RST.1.2:</a> | Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.   |
| <a href="#">LAFS.1112.RST.1.3:</a> | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.   |
| <a href="#">LAFS.1112.RST.2.4:</a> | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.  |
| <a href="#">LAFS.1112.RST.2.5:</a> | Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.   |
| <a href="#">LAFS.1112.RST.2.6:</a> | Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.   |

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| <a href="#">LAFS.1112.RST.3.7:</a>  | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.  |
| <a href="#">LAFS.1112.RST.3.8:</a>  | Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.  |
| <a href="#">LAFS.1112.RST.3.9:</a>  | Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.  |
| <a href="#">LAFS.1112.RST.4.10:</a> | By the end of grade 12, read and comprehend science/technical texts in the grades 11–12 text complexity band independently and proficiently.   |
| <a href="#">LAFS.1112.WHST.1.1:</a> | <p>Write arguments focused on <i>discipline-specific content</i>.</p> <ol style="list-style-type: none"> <li>a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.</li> <li>b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience’s knowledge level, concerns, values, and possible biases.</li> <li>c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.</li> <li>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.</li> <li>e. Provide a concluding statement or section that follows from or supports the argument presented.</li> </ol> |
| <a href="#">LAFS.1112.WHST.1.2:</a> | <p>Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.</p> <ol style="list-style-type: none"> <li>a. Introduce a topic and organize complex ideas, concepts,</li> </ol>   |

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|  | <p>and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.</p> <ul style="list-style-type: none"> <li>b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience’s knowledge of the topic.</li> <li>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.</li> <li>d. Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.</li> <li>e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic).</li> </ul> |
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[LAFS.1112.WHST.2.4:](#) Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

[LAFS.1112.WHST.2.5:](#) Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

[LAFS.1112.WHST.2.6:](#) Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.

[LAFS.1112.WHST.3.7:](#) Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

[LAFS.1112.WHST.3.8:](#) Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a

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|                                      | standard format for citation.  |
| <a href="#">LAFS.1112.WHST.3.9:</a>  | Draw evidence from informational texts to support analysis, reflection, and research.  |
| <a href="#">LAFS.1112.WHST.4.10:</a> | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.   |
| <a href="#">HE.912.C.1.3:</a>        | Evaluate how environment and personal health are interrelated.<br><div style="border: 1px solid black; padding: 5px; margin-top: 5px;"> <p><b>Remarks/Examples:</b><br/> Food options within a community; prenatal-care services; availability of recreational facilities; air quality; weather-safety awareness; and weather, air, and water conditions.</p> </div> |
| <a href="#">HE.912.C.1.5:</a>        | Analyze strategies for prevention, detection, and treatment of communicable and chronic diseases.<br><div style="border: 1px solid black; padding: 5px; margin-top: 5px;"> <p><b>Remarks/Examples:</b><br/> Health prevention, detection, and treatment of: breast and testicular cancer, suicide, obesity, and industrial-related chronic disease.</p> </div>       |
| <a href="#">HE.912.C.1.7:</a>        | Analyze how heredity and family history can impact personal health.<br><div style="border: 1px solid black; padding: 5px; margin-top: 5px;"> <p><b>Remarks/Examples:</b><br/> Drug use, family obesity, heart disease, mental health, and non-communicable illness or disease.</p> </div>  |
| <a href="#">ELD.K12.ELL.1.1:</a>     | English language learners communicate for social and instructional purposes within the school setting.   |
| <a href="#">ELD.K12.ELL.XX.1:</a>    | English language learners communicate information, ideas and concepts necessary for academic success in the content area of Science.   |

## **Anatomy and Physiology Honors (#2000360)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 2000360

**Abbreviated Title:** ANAT PHYSIO HON

**Number of Credits:** One credit (1)

**Course Length:** Year (Y)

**Honors?** Yes

**Course Type:** Core

**Course Level:** 3

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 9,10,11,12

### **GENERAL NOTES**

While the content focus of this course is consistent with the Anatomy and Physiology course, students will explore these concepts in greater depth. In general, the academic pace and rigor will be greatly increased for honors level course work. Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National Science Teachers Association (NSTA) recommends that at the high school level, all students should be in the science lab or field, collecting data every week. School laboratory investigations (labs) are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the high school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (National Research Council, 2006, p.77; NSTA, 2007).

### **Special Notes:**

#### **Instructional Practices**

Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:

1. Ensuring wide reading from complex text that varies in length.
2. Making close reading and rereading of texts central to lessons.
3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.
4. Emphasizing students supporting answers based upon evidence from the text.
5. Providing extensive research and writing opportunities (claims and evidence).



### English Language Development ELD Standards Special Notes Section:

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Science. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/SC.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

### COURSE STANDARDS

#### Integrate Standards for Mathematical Practice (MP) as applicable.

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

| Name                          | Description  |
|-------------------------------|--|
| <a href="#">SC.912.N.1.1:</a> | Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:<br><br><ol style="list-style-type: none"><li>1. <b>Pose questions about the natural world,</b> (Articulate the purpose of the investigation and identify the relevant scientific concepts).</li><li>2. <b>Conduct systematic observations,</b> (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct</li></ol> |

- and record measurements at appropriate levels of precision. Follow safety guidelines).
3. **Examine books and other sources of information to see what is already known,**
  4. **Review what is known in light of empirical evidence,** (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).
  5. **Plan investigations,** (Design and evaluate a scientific investigation).
  6. **Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),** (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).
  7. **Pose answers, explanations, or descriptions of events,**
  8. **Generate explanations that explicate or describe natural phenomena (inferences),**
  9. **Use appropriate evidence and reasoning to justify these explanations to others,**
  10. **Communicate results of scientific investigations, and**
  11. **Evaluate the merits of the explanations produced by others.**

**Remarks/Examples:**

Florida Standards Connections for 6-12 Literacy in Science

For Students in Grades 9-10

LAFS.910.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.

LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form

(e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.

For Students in Grades 11-12

LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks analyze the specific results based on explanations in the text.

LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.

Florida Standards Connections for Mathematical Practices

MAFS.K12.MP.1: Make sense of problems and persevere in solving them.

MAFS.K12.MP.2: Reason abstractly and quantitatively.

MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]

MAFS.K12.MP.4: Model with mathematics.

|                                 |  |
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|                                 | <p>MAFS.K12.MP.5: Use appropriate tools strategically.<br/> MAFS.K12.MP.6: Attend to precision.<br/> MAFS.K12.MP.7: Look for and make use of structure.<br/> MAFS.K12.MP.8: Look for and express regularity in repeated reasoning.</p>   |
| <a href="#">SC.912.N.1.2:</a>   | <p>Describe and explain what characterizes science and its methods.</p> <p><b>Remarks/Examples:</b><br/> Science is characterized by empirical observations, testable questions, formation of hypotheses, and experimentation that results in stable and replicable results, logical reasoning, and coherent theoretical constructs.</p> <p>Florida Standards Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others.</p> |
| <a href="#">SC.912.L.14.19:</a> | <p>Explain the physiology of skeletal muscle.</p>  |
| <a href="#">SC.912.L.14.20:</a> | <p>Identify the major muscles of the human on a model or diagram.</p> <p><b>Remarks/Examples:</b><br/> Refer to MAFS.K12.MP.4: Model with mathematics.</p>   |
| <a href="#">SC.912.L.14.12:</a> | <p>Describe the anatomy and histology of bone tissue.</p>  |
| <a href="#">SC.912.L.14.13:</a> | <p>Distinguish between bones of the axial skeleton and the appendicular skeleton.</p>  |
| <a href="#">SC.912.L.14.11:</a> | <p>Classify and state the defining characteristics of epithelial tissue, connective tissue, muscle tissue, and nervous tissue.</p>   |
| <a href="#">SC.912.L.14.14:</a> | <p>Identify the major bones of the axial and appendicular skeleton.</p>  |
| <a href="#">SC.912.L.14.15:</a> | <p>Identify major markings (such as foramina, fossae, tubercles, etc.) on a skeleton. Explain why these markings are important.</p>  |
| <a href="#">SC.912.L.14.16:</a> | <p>Describe the anatomy and histology, including ultrastructure, of muscle tissue.</p>   |
| <a href="#">SC.912.L.14.17:</a> | <p>List the steps involved in the sliding filament of muscle contraction.</p>  |
| <a href="#">SC.912.L.14.18:</a> | <p>Describe signal transmission across a myoneural junction.</p>   |
| <a href="#">SC.912.L.14.21:</a> | <p>Describe the anatomy, histology, and physiology of the central and peripheral nervous systems and name the major divisions of the nervous system.</p>   |
| <a href="#">SC.912.L.14.22:</a> | <p>Describe the physiology of nerve conduction, including the generator potential, action potential, and the synapse.</p>  |

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| <a href="#">SC.912.L.14.23:</a> | Identify the parts of a reflex arc.   |
| <a href="#">SC.912.L.14.25:</a> | Identify the major parts of a cross section through the spinal cord.  |
| <a href="#">SC.912.L.14.27:</a> | Identify the functions of the major parts of the brain, including the meninges, medulla, pons, midbrain, hypothalamus, thalamus, cerebellum and cerebrum.                       |
| <a href="#">SC.912.L.14.28:</a> | Identify the major functions of the spinal cord.  |
| <a href="#">SC.912.L.14.29:</a> | Define the terms endocrine and exocrine.  |
| <a href="#">SC.912.L.14.30:</a> | Compare endocrine and neural controls of physiology.  |
| <a href="#">SC.912.L.14.31:</a> | Describe the physiology of hormones including the different types and the mechanisms of their action.   |
| <a href="#">SC.912.L.14.34:</a> | Describe the composition and physiology of blood, including that of the plasma and the formed elements.   |
| <a href="#">SC.912.L.14.35:</a> | Describe the steps in hemostasis, including the mechanism of coagulation. Include the basis for blood typing and transfusion reactions.   |
| <a href="#">SC.912.L.14.36:</a> | Describe the factors affecting blood flow through the cardiovascular system.  |
| <a href="#">SC.912.L.14.37:</a> | Explain the components of an electrocardiogram.   |
| <a href="#">SC.912.L.14.38:</a> | Describe normal heart sounds and what they mean.  |
| <a href="#">SC.912.L.14.39:</a> | Describe hypertension and some of the factors that produce it.  |
| <a href="#">SC.912.L.14.41:</a> | Describe fetal circulation and changes that occur to the circulatory system at birth.   |
| <a href="#">SC.912.L.14.40:</a> | Describe the histology of the major arteries and veins of systemic, pulmonary, hepatic portal, and coronary circulation.  |
| <a href="#">SC.912.L.14.42:</a> | Describe the anatomy and the physiology of the lymph system.  |
| <a href="#">SC.912.L.14.43:</a> | Describe the histology of the respiratory system.   |
| <a href="#">SC.912.L.14.44:</a> | Describe the physiology of the respiratory system including the mechanisms of ventilation, gas exchange, gas transport and the mechanisms that control the rate of ventilation. |
| <a href="#">SC.912.L.14.45:</a> | Describe the histology of the alimentary canal and its associated accessory organs.   |
| <a href="#">SC.912.L.14.46:</a> | Describe the physiology of the digestive system, including mechanical digestion, chemical digestion, absorption and the neural and hormonal mechanisms of control.              |
| <a href="#">SC.912.L.14.47:</a> | Describe the physiology of urine formation by the kidney.   |
| <a href="#">SC.912.L.14.48:</a> | Describe the anatomy, histology, and physiology of the ureters, the urinary bladder and the urethra.  |
| <a href="#">SC.912.L.14.49:</a> | Identify the major functions associated with the sympathetic and parasympathetic nervous systems.   |
| <a href="#">SC.912.L.14.50:</a> | Describe the structure of vertebrate sensory organs. Relate   |

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|                                 | structure to function in vertebrate sensory systems.  |
| <a href="#">SC.912.L.14.51:</a> | Describe the function of the vertebrate integumentary system.   |
| <a href="#">SC.912.L.14.52:</a> | <p>Explain the basic functions of the human immune system, including specific and nonspecific immune response, vaccines, and antibiotics.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b></p> <p>Annually Assessed on Biology EOC. Also assesses <a href="#">SC.912.L.14.6</a> <a href="#">HE.912.C.1.7</a> and <a href="#">HE.912.C.1.5</a>.</p> </div> |
| <a href="#">SC.912.L.16.8:</a>  | <p>Explain the relationship between mutation, cell cycle, and uncontrolled cell growth potentially resulting in cancer.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b></p> <p>Integrate <a href="#">HE.912.C.1.7</a>. Analyze how heredity and family history can impact personal health.</p> </div>  |
| <a href="#">SC.912.L.16.10:</a> | <p>Evaluate the impact of biotechnology on the individual, society and the environment, including medical and ethical issues.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b></p> <p>Annually assessed on Biology EOC.</p> </div>  |
| <a href="#">SC.912.L.16.13:</a> | <p>Describe the basic anatomy and physiology of the human reproductive system. Describe the process of human development from fertilization to birth and major changes that occur in each trimester of pregnancy.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b></p> <p>Annually assessed on Biology EOC.</p> </div>                                    |
| <a href="#">SC.912.L.18.2:</a>  | Describe the important structural characteristics of monosaccharides, disaccharides, and polysaccharides and explain the functions of carbohydrates in living things.   |
| <a href="#">SC.912.L.18.3:</a>  | Describe the structures of fatty acids, triglycerides, phospholipids, and steroids. Explain the functions of lipids in living organisms. Identify some reactions that fatty acids undergo. Relate the structure and function of cell membranes.   |
| <a href="#">SC.912.L.18.4:</a>  | Describe the structures of proteins and amino acids. Explain the functions of proteins in living organisms. Identify some reactions that amino acids undergo. Relate the structure and function of enzymes.   |
| <a href="#">SC.912.L.18.6:</a>  | Discuss the role of anaerobic respiration in living things and in human society.  |
| <a href="#">SC.912.L.18.8:</a>  | Identify the reactants, products, and basic functions of aerobic  |

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|                                    | and anaerobic cellular respiration.   |
| <a href="#">SC.912.L.18.11:</a>    | Explain the role of enzymes as catalysts that lower the activation energy of biochemical reactions. Identify factors, such as pH and temperature, and their effect on enzyme activity.  |
| <a href="#">MAFS.912.N-Q.1.1:</a>  | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. ★   |
| <a href="#">MAFS.912.N-Q.1.3:</a>  | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. ★   |
| <a href="#">MAFS.912.F-IF.2.4:</a> | For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. <i>Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</i> ★   |
| <a href="#">MAFS.912.F-IF.3.7:</a> | Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★ <ul style="list-style-type: none"> <li>a. Graph linear and quadratic functions and show intercepts, maxima, and minima.</li> <li>b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.</li> <li>c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.</li> <li>d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.</li> <li>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.</li> </ul> |
| <a href="#">MAFS.912.S-ID.1.1:</a> | Represent data with plots on the real number line (dot plots, histograms, and box plots). ★   |
|                                    | <p><b>Remarks/Examples:</b><br/> In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic</p>  |

|   |  |
|---|--|
|   | <p>appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.</p>   |
| <p><a href="#">MAFS.912.S-ID.1.2:</a></p> | <p>Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. ★</p> <p><b>Remarks/Examples:</b><br/> In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.</p> |
| <p><a href="#">MAFS.912.S-ID.1.3:</a></p> | <p>Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). ★</p> <p><b>Remarks/Examples:</b><br/> In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.</p>                                     |
| <p><a href="#">MAFS.912.S-ID.1.4:</a></p> | <p>Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. ★</p>  |
| <p><a href="#">MAFS.912.S-ID.2.5:</a></p> | <p>Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. ★</p>   |
| <p><a href="#">MAFS.912.S-ID.2.6:</a></p> | <p>Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. ★</p> <ol style="list-style-type: none"> <li>Fit a function to the data; use functions fitted to data to solve problems in the context of the data. <i>Use given functions or choose a function suggested by the context. Emphasize linear, and exponential models.</i></li> <li>Informally assess the fit of a function by plotting and analyzing residuals.</li> </ol>                |



- c. Fit a linear function for a scatter plot that suggests a linear association.

**Remarks/Examples:**

Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals.

[MAFS.912.S-IC.2.6:](#)

Evaluate reports based on data. ★

Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.

[LAFS.1112.SL.1.1:](#)

- a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.
- b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.
- c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.
- d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task.

[LAFS.1112.SL.1.2:](#)

Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.

[LAFS.1112.SL.1.3:](#)

Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links

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|                                     | among ideas, word choice, points of emphasis, and tone used.  |
| <a href="#">LAFS.1112.SL.2.4:</a>   | Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. |
| <a href="#">LAFS.1112.SL.2.5:</a>   | Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.   |
| <a href="#">LAFS.1112.RST.1.1:</a>  | Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.  |
| <a href="#">LAFS.1112.RST.1.2:</a>  | Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.   |
| <a href="#">LAFS.1112.RST.1.3:</a>  | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.   |
| <a href="#">LAFS.1112.RST.2.4:</a>  | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.  |
| <a href="#">LAFS.1112.RST.2.5:</a>  | Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.   |
| <a href="#">LAFS.1112.RST.2.6:</a>  | Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.   |
| <a href="#">LAFS.1112.RST.3.7:</a>  | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.   |
| <a href="#">LAFS.1112.RST.3.8:</a>  | Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.   |
| <a href="#">LAFS.1112.RST.3.9:</a>  | Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.   |
| <a href="#">LAFS.1112.RST.4.10:</a> | By the end of grade 12, read and comprehend science/technical   |

texts in the grades 11–12 text complexity band independently and proficiently.

Write arguments focused on *discipline-specific content*.

[LAFS.1112.WHST.1.1:](#)

- a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.
- b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience’s knowledge level, concerns, values, and possible biases.
- c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.
- d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
- e. Provide a concluding statement or section that follows from or supports the argument presented.

[LAFS.1112.WHST1.1d:](#)

Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

[LAFS.1112.WHST.1.2:](#)

Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

- a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.
- b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience’s knowledge of the topic.

- c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.
- d. Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.
- e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic).

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| <a href="#">LAFS.1112.WHST.2.4:</a>  | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.  |
| <a href="#">LAFS.1112.WHST.2.5:</a>  | Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.  |
| <a href="#">LAFS.1112.WHST.2.6:</a>  | Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.  |
| <a href="#">LAFS.1112.WHST.3.7:</a>  | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.  |
| <a href="#">LAFS.1112.WHST.3.8:</a>  | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. |
| <a href="#">LAFS.1112.WHST.3.9:</a>  | Draw evidence from informational texts to support analysis, reflection, and research.   |
| <a href="#">LAFS.1112.WHST.4.10:</a> | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.  |
| <a href="#">HE.912.C.1.3:</a>        | Evaluate how environment and personal health are interrelated.  |

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|                                   | <p><b>Remarks/Examples:</b><br/> Food options within a community; prenatal-care services; availability of recreational facilities; air quality; weather-safety awareness; and weather, air, and water conditions.</p>   |
| <a href="#">HE.912.C.1.5:</a>     | <p>Analyze strategies for prevention, detection, and treatment of communicable and chronic diseases.</p> <p><b>Remarks/Examples:</b><br/> Health prevention, detection, and treatment of: breast and testicular cancer, suicide, obesity, and industrial-related chronic disease.</p> |
| <a href="#">HE.912.C.1.7:</a>     | <p>Analyze how heredity and family history can impact personal health.</p> <p><b>Remarks/Examples:</b><br/> Drug use, family obesity, heart disease, mental health, and non-communicable illness or disease.</p>  |
| <a href="#">ELD.K12.ELL.1.1:</a>  | <p>English language learners communicate for social and instructional purposes within the school setting.</p>   |
| <a href="#">ELD.K12.ELL.XX.1:</a> | <p>English language learners communicate information, ideas and concepts necessary for academic success in the content area of Science.</p>   |

## **Astronomy Solar/Galactic (#2001350)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 2001350

**Abbreviated Title:** ASTRONOMY S/G

**Number of Credits:** One credit (1)

**Course Length:** Year (Y)

**Course Type:** Core

**Course Level:** 2

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 9,10,11,12

### **GENERAL NOTES**

Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National Science Teachers Association (NSTA) recommends that at the high school level, all students should be in the science lab or field, collecting data every week. School laboratory investigations (labs) are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the high school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (National Research Council, 2006, p.77; NSTA, 2007).

### **Special Notes:**

#### **Instructional Practices**

Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:

1. Ensuring wide reading from complex text that varies in length.
2. Making close reading and rereading of texts central to lessons.
3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.
4. Emphasizing students supporting answers based upon evidence from the text.
5. Providing extensive research and writing opportunities (claims and evidence).

**Science and Engineering Practices** (NRC *Framework for K-12 Science Education, 2010*)

- Asking questions (for science) and defining problems (for engineering).
- Developing and using models.
- Planning and carrying out investigations.
- Analyzing and interpreting data.
- Using mathematics, information and computer technology, and computational thinking.
- Constructing explanations (for science) and designing solutions (for engineering).
- Engaging in argument from evidence.
- Obtaining, evaluating, and communicating information.

**English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Science. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/SC.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

**COURSE STANDARDS**

**Integrate Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

| Name                          | Description   |
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| <a href="#">SC.912.N.1.1:</a> | Define a problem based on a specific body of knowledge, for |

example: biology, chemistry, physics, and earth/space science, and do the following:

1. **Pose questions about the natural world,** (Articulate the purpose of the investigation and identify the relevant scientific concepts).
2. **Conduct systematic observations,** (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).
3. **Examine books and other sources of information to see what is already known,**
4. **Review what is known in light of empirical evidence,** (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).
5. **Plan investigations,** (Design and evaluate a scientific investigation).
6. **Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),** (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).
7. **Pose answers, explanations, or descriptions of events,**
8. **Generate explanations that explicate or describe natural phenomena (inferences),**
9. **Use appropriate evidence and reasoning to justify these explanations to others,**
10. **Communicate results of scientific investigations, and**
11. **Evaluate the merits of the explanations produced by others.**

**Remarks/Examples:**

Florida Standards Connections for 6-12 Literacy in Science

For Students in Grades 9-10

LAFS.910.RST.1.1 Cite specific textual evidence to support



analysis of science and technical texts, attending to the precise details of explanations or descriptions.

LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.

LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.

For Students in Grades 11-12

LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks analyze the specific results based on explanations in the text.

LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.

Florida Standards Connections for Mathematical Practices

- MAFS.K12.MP.1: Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2: Reason abstractly and quantitatively.
- MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]
- MAFS.K12.MP.4: Model with mathematics.
- MAFS.K12.MP.5: Use appropriate tools strategically.
- MAFS.K12.MP.6: Attend to precision.
- MAFS.K12.MP.7: Look for and make use of structure.
- MAFS.K12.MP.8: Look for and express regularity in repeated reasoning.

[SC.912.N.1.2:](#)

Describe and explain what characterizes science and its methods.

**Remarks/Examples:**

Science is characterized by empirical observations, testable questions, formation of hypotheses, and experimentation that results in stable and replicable results, logical reasoning, and coherent theoretical constructs.

Florida Standards Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others.

[SC.912.N.1.3:](#)

Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented.

**Remarks/Examples:**

Assess the reliability of data and identify reasons for inconsistent results, such as sources of error or uncontrolled conditions.

Florida Standards Connections: MAFS.K12.MP.2: Reason abstractly and quantitatively MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others

[SC.912.N.1.4:](#)

Identify sources of information and assess their reliability according to the strict standards of scientific investigation.

**Remarks/Examples:**

Read, interpret, and examine the credibility and validity of

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|                                      | <p>scientific claims in different sources of information, such as scientific articles, advertisements, or media stories. Strict standards of science include controlled variables, sufficient sample size, replication of results, empirical and measurable evidence, and the concept of falsification.</p> <p>Florida Standards Connections: <a href="#">LAFS.910.RST.1.1</a> / <a href="#">LAFS.1112.RST.1.1</a>.</p>   |
| <p><a href="#">SC.912.N.1.5:</a></p> | <p>Describe and provide examples of how similar investigations conducted in many parts of the world result in the same outcome.</p> <p><b>Remarks/Examples:</b><br/>Recognize that contributions to science can be made and have been made by people from all over the world.</p>   |
| <p><a href="#">SC.912.N.1.6:</a></p> | <p>Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.</p> <p><b>Remarks/Examples:</b><br/>Collect data/evidence and use tables/graphs to draw conclusions and make inferences based on patterns or trends in the data.</p> <p>Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them.</p>   |
| <p><a href="#">SC.912.N.1.7:</a></p> | <p>Recognize the role of creativity in constructing scientific questions, methods and explanations.</p> <p><b>Remarks/Examples:</b><br/>Work through difficult problems using creativity, and critical and analytical thinking in problem solving (e.g. convergent versus divergent thinking and creativity in problem solving).</p> <p>Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them and MAFS.K12.MP.2: Reason abstractly and quantitatively.</p> |
| <p><a href="#">SC.912.N.2.1:</a></p> | <p>Identify what is science, what clearly is not science, and what superficially resembles science (but fails to meet the criteria for science).</p> <p><b>Remarks/Examples:</b></p>  |

Science is the systematic and organized inquiry that is derived from observations and experimentation that can be verified or tested by further investigation to explain natural phenomena (e.g. Science is testable, pseudo-science is not science seeks falsifications, pseudo-science seeks confirmations.)

Identify which questions can be answered through science and which questions are outside the boundaries of scientific investigation, such as questions addressed by other ways of knowing, such as art, philosophy, and religion.

[SC.912.N.2.2:](#)

**Remarks/Examples:**

Identify scientific questions that can be disproved by experimentation/testing. Recognize that pseudoscience is a claim, belief, or practice which is presented as scientific, but does not adhere to strict standards of science (e.g. controlled variables, sample size, replicability, empirical and measurable evidence, and the concept of falsification).

Florida Standards Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others.

Identify examples of pseudoscience (such as astrology, phrenology) in society.

[SC.912.N.2.3:](#)

**Remarks/Examples:**

Determine if the phenomenon (event) can be observed, measured, and tested through scientific experimentation.

Explain that scientific knowledge is both durable and robust and open to change. Scientific knowledge can change because it is often examined and re-examined by new investigations and scientific argumentation. Because of these frequent examinations, scientific knowledge becomes stronger, leading to its durability.

[SC.912.N.2.4:](#)

**Remarks/Examples:**

Recognize that ideas with the most durable explanatory power become established theories, but scientific explanations are continually subjected to change in the face of new evidence.

Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them

MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others.

Describe instances in which scientists' varied backgrounds, talents, interests, and goals influence the inferences and thus the explanations that they make about observations of natural phenomena and describe that competing interpretations (explanations) of scientists are a strength of science as they are a source of new, testable ideas that have the potential to add new evidence to support one or another of the explanations.

[SC.912.N.2.5:](#)

**Remarks/Examples:**

Recognize that scientific questions, observations, and conclusions may be influenced by the existing state of scientific knowledge, the social and cultural context of the researcher, and the observer's experiences and expectations. Identify possible bias in qualitative and quantitative data analysis.

Explain that a scientific theory is the culmination of many scientific investigations drawing together all the current evidence concerning a substantial range of phenomena; thus, a scientific theory represents the most powerful explanation scientists have to offer.

[SC.912.N.3.1:](#)

**Remarks/Examples:**

Explain that a scientific theory is a well-tested hypothesis supported by a preponderance of empirical evidence.

Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them and, MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others.

Describe the role consensus plays in the historical development of a theory in any one of the disciplines of science.

[SC.912.N.3.2:](#)

**Remarks/Examples:**

Recognize that scientific argument, disagreement, discourse, and discussion create a broader and more accurate understanding of natural processes and events.

Florida Standards Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others.

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| <p><a href="#">SC.912.N.3.3:</a></p> | <p>Explain that scientific laws are descriptions of specific relationships under given conditions in nature, but do not offer explanations for those relationships.</p> <p><b>Remarks/Examples:</b><br/>Recognize that a scientific theory provides a broad explanation of many observed phenomena while a scientific law describes how something behaves.</p>  |
| <p><a href="#">SC.912.N.3.4:</a></p> | <p>Recognize that theories do not become laws, nor do laws become theories; theories are well supported explanations and laws are well supported descriptions.</p> <p><b>Remarks/Examples:</b><br/>Recognize that theories do not become laws, theories explain laws. Recognize that not all scientific laws have accompanying explanatory theories.</p>  |
| <p><a href="#">SC.912.N.3.5:</a></p> | <p>Describe the function of models in science, and identify the wide range of models used in science.</p> <p><b>Remarks/Examples:</b><br/>Describe how models are used by scientists to explain observations of nature.</p> <p>Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.</p>  |
| <p><a href="#">SC.912.N.4.1:</a></p> | <p>Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making.</p> <p><b>Remarks/Examples:</b><br/>Recognize that no single universal step-by-step scientific method captures the complexity of doing science. A number of shared values and perspectives characterize a scientific approach.</p> <p>MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively.</p> |
| <p><a href="#">SC.912.E.5.9:</a></p> | <p>Analyze the broad effects of space exploration on the economy and culture of Florida.</p> <p><b>Remarks/Examples:</b><br/>Recognize the economic, technical and social benefits of</p>   |

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|                                       | <p>spinoff technology developed through the space program.</p>  |
| <p><a href="#">SC.912.E.5.6:</a></p>  | <p>Develop logical connections through physical principles, including Kepler's and Newton's Laws about the relationships and the effects of Earth, Moon, and Sun on each other.</p> <p><b>Remarks/Examples:</b><br/>         Explain that Kepler's laws determine the orbits of objects in the solar system and recognize that Kepler's laws are a direct consequence of Newton's Law of Universal Gravitation and Laws of Motion.</p>            |
| <p><a href="#">SC.912.E.5.7:</a></p>  | <p>Relate the history of and explain the justification for future space exploration and continuing technology development.</p> <p><b>Remarks/Examples:</b><br/>         Identify examples of historical space exploration (e.g. telescopes, high altitude balloons, lunar landers, deep-space probes, space station) that had significant impact on current space exploration and recognize the importance of continued exploration in space.</p> |
| <p><a href="#">SC.912.E.5.8:</a></p>  | <p>Connect the concepts of radiation and the electromagnetic spectrum to the use of historical and newly-developed observational tools.</p> <p><b>Remarks/Examples:</b><br/>         Describe how frequency is related to the characteristics of electromagnetic radiation and recognize how spectroscopy is used to detect and interpret information from electromagnetic radiation sources.</p>   |
| <p><a href="#">SC.912.E.5.11:</a></p> | <p>Distinguish the various methods of measuring astronomical distances and apply each in appropriate situations.</p> <p><b>Remarks/Examples:</b><br/>         Determine which units of measurement are appropriate to describe distance (e.g. astronomical units, parallax, and light years).</p> <p>Florida Standards Connections: MAFS.K12.MP.5: Use appropriate tools strategically and MAFS.K12.MP.6: Attend to precision.</p>                |
| <p><a href="#">SC.912.E.6.2:</a></p>  | <p>Connect surface features to surface processes that are responsible for their formation.</p>  |

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|                                       | <p><b>Remarks/Examples:</b><br/>Identify various landforms (e.g. dunes, lakes, sinkholes, aquifers) and describe how they form (erosion, physical/chemical weathering, and deposition). Explain how sea level changes over time have exposed and inundated continental shelves, created and destroyed inland seas, and shaped the surface of the Earth.</p>  |
| <p><a href="#">SC.912.E.7.7:</a></p>  | <p>Identify, analyze, and relate the internal (Earth system) and external (astronomical) conditions that contribute to global climate change.</p> <p><b>Remarks/Examples:</b><br/>Explain the possible natural (e.g. increased global temperature, wildfires, volcanic dust) and anthropogenic mechanisms (e.g. air pollution, acid rain, greenhouse gases, burning of fossil fuels) and the effects of these mechanisms on global climate change.</p>   |
| <p><a href="#">SC.912.P.8.1:</a></p>  | <p>Differentiate among the four states of matter.</p> <p><b>Remarks/Examples:</b><br/>Differentiate among the four states of matter (solid, liquid, gas and plasma) in terms of energy, particle motion, and phase transitions. (Note: Currently five states of matter have been identified.)</p>  |
| <p><a href="#">SC.912.P.8.4:</a></p>  | <p>Explore the scientific theory of atoms (also known as atomic theory) by describing the structure of atoms in terms of protons, neutrons and electrons, and differentiate among these particles in terms of their mass, electrical charges and locations within the atom.</p> <p><b>Remarks/Examples:</b><br/>Explain that electrons, protons and neutrons are parts of the atom and that the nuclei of atoms are composed of protons and neutrons, which experience forces of attraction and repulsion consistent with their charges and masses.</p> <p>Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.</p> |
| <p><a href="#">SC.912.P.10.9:</a></p> | <p>Describe the quantization of energy at the atomic level.</p> <p><b>Remarks/Examples:</b></p>  |



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|  | <p>Explain that when electrons transition to higher energy levels they absorb energy, and when they transition to lower energy levels they emit energy. Recognize that spectral lines are the result of transitions of electrons between energy levels that correspond to photons of light with an energy and frequency related to the energy spacing between levels (Planck's relationship <math>E = h\nu</math>).</p>   |
| <p><a href="#">SC.912.P.10.4:</a></p>  | <p>Describe heat as the energy transferred by convection, conduction, and radiation, and explain the connection of heat to change in temperature or states of matter.</p>   |
| <p><a href="#">SC.912.P.10.11:</a></p> | <p>Explain and compare nuclear reactions (radioactive decay, fission and fusion), the energy changes associated with them and their associated safety issues.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b></p> <p>Identify the three main types of radioactive decay (alpha, beta, and gamma) and compare their properties (composition, mass, charge, and penetrating power). Explain the concept of half-life for an isotope (e.g. C-14 is used to determine the age of objects) and calculate the amount of a radioactive substance remaining after an integral number of half-lives have passed. Recognize that the energy release per gram of material is much larger in nuclear fusion or fission reactions than in chemical reactions due to the large amount of energy related to small amounts of mass by equation <math>E=mc^2</math>.</p> </div> |
| <p><a href="#">SC.912.P.10.18:</a></p> | <p>Explore the theory of electromagnetism by comparing and contrasting the different parts of the electromagnetic spectrum in terms of wavelength, frequency, and energy, and relate them to phenomena and applications.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b></p> <p>Describe the electromagnetic spectrum (i.e., radio waves, microwaves, infrared, visible light, ultraviolet, X-rays and gamma rays) in terms of frequency, wavelength and energy. Solve problems involving wavelength, frequency, and energy.</p> </div>   |
| <p><a href="#">SC.912.P.10.19:</a></p> | <p>Explain that all objects emit and absorb electromagnetic radiation and distinguish between objects that are blackbody radiators and those that are not.</p>  |
| <p><a href="#">SC.912.P.10.20:</a></p> | <p>Describe the measurable properties of waves and explain the relationships among them and how these properties change when the wave moves from one medium to another.</p>   |

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|  | <p><b>Remarks/Examples:</b></p> <p>Describe the measurable properties of waves (velocity, frequency, wavelength, amplitude, period, reflection and refraction) and explain the relationships among them. Recognize that the source of all waves is a vibration and waves carry energy from one place to another. Distinguish between transverse and longitudinal waves in mechanical media, such as springs and ropes, and on the earth (seismic waves). Describe sound as a longitudinal wave whose speed depends on the properties of the medium in which it propagates.</p> |
| <p><a href="#">SC.912.P.10.21:</a></p> | <p>Qualitatively describe the shift in frequency in sound or electromagnetic waves due to the relative motion of a source or a receiver.</p> <p><b>Remarks/Examples:</b></p> <p>Describe the apparent change in frequency of waves due to the motion of a source or a receiver (the Doppler effect).</p>   |
| <p><a href="#">SC.912.P.10.22:</a></p> | <p>Construct ray diagrams and use thin lens and mirror equations to locate the images formed by lenses and mirrors.</p> <p><b>Remarks/Examples:</b></p> <p>Use examples such as converging/diverging lenses and convex/concave mirrors. Use a ray diagram to determine the approximate location and size of the image, and the mirror equation to obtain numerical information about image distance and image size.</p>  |
| <p><a href="#">SC.912.P.12.6:</a></p>  | <p>Qualitatively apply the concept of angular momentum.</p> <p><b>Remarks/Examples:</b></p> <p>Explain that angular momentum is rotational analogy to linear momentum (e.g. Because angular momentum is conserved, a change in the distribution of mass about the axis of rotation will cause a change in the rotational speed [ice skater spinning]).</p>   |
| <p><a href="#">SC.912.P.12.2:</a></p>  | <p>Analyze the motion of an object in terms of its position, velocity, and acceleration (with respect to a frame of reference) as functions of time.</p> <p><b>Remarks/Examples:</b></p> <p>Solve problems involving distance, velocity, speed, and</p>  |

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|   | <p>acceleration. Create and interpret graphs of 1-dimensional motion, such as position versus time, distance versus time, speed versus time, velocity versus time, and acceleration versus time where acceleration is constant.</p> <p>Florida Standards Connections: MAFS.912.N-VM.3 (+)<br/>Solve problems involving velocity and other quantities that can be represented by vectors.</p>   |
| <p><a href="#">SC.912.P.12.4:</a></p>     | <p>Describe how the gravitational force between two objects depends on their masses and the distance between them.</p> <p><b>Remarks/Examples:</b></p> <p>Describe Newton's law of universal gravitation in terms of the attraction between two objects, their masses, and the inverse square of the distance between them.</p>  |
| <p><a href="#">SC.912.P.12.7:</a></p>     | <p>Recognize that nothing travels faster than the speed of light in vacuum which is the same for all observers no matter how they or the light source are moving.</p> <p><b>Remarks/Examples:</b></p> <p>Recognize that regardless of the speed of an observer or source, <i>in a vacuum</i> the speed of light is always <math>c</math>.</p>  |
| <p><a href="#">MAFS.912.N-Q.1.1:</a></p>  | <p>Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. ★</p>   |
| <p><a href="#">MAFS.912.N-Q.1.3:</a></p>  | <p>Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. ★</p>   |
| <p><a href="#">MAFS.912.F-IF.3.7:</a></p> | <p>Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★</p> <ol style="list-style-type: none"> <li>Graph linear and quadratic functions and show intercepts, maxima, and minima.</li> <li>Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.</li> <li>Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.</li> <li>Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available,</li> </ol> |

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|   | <p>and showing end behavior.</p> <p>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.</p>   |
| <p><a href="#">LAFS.910.SL.1.1:</a></p> | <p>Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.</p> <p>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.</p> <p>b. Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed.</p> <p>c. Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.</p> <p>d. Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.</p> |
| <p><a href="#">LAFS.910.SL.1.2:</a></p> | <p>Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.</p>  |
| <p><a href="#">LAFS.910.SL.1.3:</a></p> | <p>Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.</p>   |
| <p><a href="#">LAFS.910.SL.2.4:</a></p> | <p>Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.</p>   |
| <p><a href="#">LAFS.910.SL.2.5:</a></p> | <p>Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.</p>   |

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| <a href="#">LAFS.910.RST.1.1:</a>  | Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.  |
| <a href="#">LAFS.910.RST.1.2:</a>  | Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.  |
| <a href="#">LAFS.910.RST.1.3:</a>  | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.   |
| <a href="#">LAFS.910.RST.2.4:</a>  | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.   |
| <a href="#">LAFS.910.RST.2.5:</a>  | Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).   |
| <a href="#">LAFS.910.RST.2.6:</a>  | Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.   |
| <a href="#">LAFS.910.RST.3.7:</a>  | Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.  |
| <a href="#">LAFS.910.RST.3.8:</a>  | Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.   |
| <a href="#">LAFS.910.RST.3.9:</a>  | Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.  |
| <a href="#">LAFS.910.RST.4.10:</a> | By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.   |
| <a href="#">LAFS.910.WHST.1.1:</a> | <p>Write arguments focused on <i>discipline-specific content</i>.</p> <ol style="list-style-type: none"> <li>a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.</li> <li>b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience's knowledge level</li> </ol> |

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|   | <p>and concerns.</p> <ul style="list-style-type: none"> <li>c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.</li> <li>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.</li> <li>e. Provide a concluding statement or section that follows from or supports the argument presented.</li> </ul>  |
| <p><a href="#">LAFS.910.WHST.1.2:</a></p> | <p>Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.</p> <ul style="list-style-type: none"> <li>a. Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.</li> <li>b. Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience’s knowledge of the topic.</li> <li>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts.</li> <li>d. Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.</li> <li>e. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.</li> <li>f. Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).</li> </ul> |
| <p><a href="#">LAFS.910.WHST.2.4:</a></p> | <p>Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.</p>  |
| <p><a href="#">LAFS.910.WHST.2.5:</a></p> | <p>Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and</p>  |

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|                                     | audience.   |
| <a href="#">LAFS.910.WHST.2.6:</a>  | Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.  |
| <a href="#">LAFS.910.WHST.3.7:</a>  | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.  |
| <a href="#">LAFS.910.WHST.3.8:</a>  | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation. |
| <a href="#">LAFS.910.WHST.3.9:</a>  | Draw evidence from informational texts to support analysis, reflection, and research.   |
| <a href="#">LAFS.910.WHST.4.10:</a> | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.  |
| <a href="#">ELD.K12.ELL.1.1:</a>    | English language learners communicate for social and instructional purposes within the school setting.  |
| <a href="#">ELD.K12.ELL.XX.1:</a>   | English language learners communicate information, ideas and concepts necessary for academic success in the content area of Science.  |

## **Astronomy Solar/Galactic Honors (#2020910)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 2020910

**Abbreviated Title:** ASTR S/G HON

**Number of Credits:** One credit (1)

**Course Length:** Year (Y)

**Honors?** Yes

**Course Type:** Core

**Course Level:** 3

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 9,10,11,12

### **GENERAL NOTES**

While the content focus of this course is consistent with the Astronomy Solar/Galactic course, students will explore these concepts in greater depth. In general, the academic pace and rigor will be greatly increased for honors level course work. Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National Science Teachers Association (NSTA) recommends that at the high school level, all students should be in the science lab or field, collecting data every week. School laboratory investigations (labs) are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the high school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (National Research Council, 2006, p.77; NSTA, 2007).

### **Special Notes:**

Instructional Practices Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:

1. Ensuring wide reading from complex text that varies in length.
2. Making close reading and rereading of texts central to lessons.
3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.
4. Emphasizing students supporting answers based upon evidence from the text.
5. Providing extensive research and writing opportunities (claims and evidence).



**Science and Engineering Practices** (NRC *Framework for K-12 Science Education, 2010*)

- Asking questions (for science) and defining problems (for engineering).
- Developing and using models.
- Planning and carrying out investigations.
- Analyzing and interpreting data.
- Using mathematics, information and computer technology, and computational thinking.
- Constructing explanations (for science) and designing solutions (for engineering).
- Engaging in argument from evidence.
- Obtaining, evaluating, and communicating information.

**English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Science. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/SC.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

**COURSE STANDARDS**

**Integrate Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

| Name                                 | Description   |
|--------------------------------------|---|
| <p><a href="#">SC.912.N.1.1:</a></p> | <p>Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:</p> <ol style="list-style-type: none"> <li>1. <b>Pose questions about the natural world,</b> (Articulate the purpose of the investigation and identify the relevant scientific concepts).</li> <li>2. <b>Conduct systematic observations,</b> (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).</li> <li>3. <b>Examine books and other sources of information to see what is already known,</b></li> <li>4. <b>Review what is known in light of empirical evidence,</b> (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).</li> <li>5. <b>Plan investigations,</b> (Design and evaluate a scientific investigation).</li> <li>6. <b>Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),</b> (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).</li> <li>7. <b>Pose answers, explanations, or descriptions of events,</b></li> <li>8. <b>Generate explanations that explicate or describe natural phenomena (inferences),</b></li> <li>9. <b>Use appropriate evidence and reasoning to justify these explanations to others,</b></li> <li>10. <b>Communicate results of scientific investigations, and</b></li> <li>11. <b>Evaluate the merits of the explanations produced by others.</b></li> </ol> <div style="border: 1px solid black; padding: 10px; margin-top: 20px;"> <p><b>Remarks/Examples:</b></p> <p>Florida Standards Connections for 6-12 Literacy in Science</p> </div> |

For Students in Grades 9-10

LAFS.910.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.

LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.

For Students in Grades 11-12

LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks analyze the specific results based on explanations in the text.

LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific

procedures/ experiments, or technical processes.

LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.

Florida Standards Connections for Mathematical Practices

MAFS.K12.MP.1: Make sense of problems and persevere in solving them.

MAFS.K12.MP.2: Reason abstractly and quantitatively.

MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]

MAFS.K12.MP.4: Model with mathematics.

MAFS.K12.MP.5: Use appropriate tools strategically.

MAFS.K12.MP.6: Attend to precision.

MAFS.K12.MP.7: Look for and make use of structure.

MAFS.K12.MP.8: Look for and express regularity in repeated reasoning.

Describe and explain what characterizes science and its methods.

[SC.912.N.1.2:](#)

**Remarks/Examples:**

Science is characterized by empirical observations, testable questions, formation of hypotheses, and experimentation that results in stable and replicable results, logical reasoning, and coherent theoretical constructs.

Florida Standards Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others.

Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented.

[SC.912.N.1.3:](#)

**Remarks/Examples:**

Assess the reliability of data and identify reasons for inconsistent results, such as sources of error or uncontrolled conditions.

Florida Standards Connections: MAFS.K12.MP.2: Reason abstractly and quantitatively MAFS.K12.MP.3: Construct

viable arguments and critique the reasoning of others

Identify sources of information and assess their reliability according to the strict standards of scientific investigation.

[SC.912.N.1.4:](#)

**Remarks/Examples:**

Read, interpret, and examine the credibility and validity of scientific claims in different sources of information, such as scientific articles, advertisements, or media stories. Strict standards of science include controlled variables, sufficient sample size, replication of results, empirical and measurable evidence, and the concept of falsification.

Florida Standards Connections: [LAFS.910.RST.1.1](#) / [LAFS.1112.RST.1.1](#).

Describe and provide examples of how similar investigations conducted in many parts of the world result in the same outcome.

[SC.912.N.1.5:](#)

**Remarks/Examples:**

Recognize that contributions to science can be made and have been made by people from all over the world.

Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.

[SC.912.N.1.6:](#)

**Remarks/Examples:**

Collect data/evidence and use tables/graphs to draw conclusions and make inferences based on patterns or trends in the data.

Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them.

Recognize the role of creativity in constructing scientific questions, methods and explanations.

[SC.912.N.1.7:](#)

**Remarks/Examples:**

Work through difficult problems using creativity, and critical and analytical thinking in problem solving (e.g. convergent versus divergent thinking and creativity in problem solving).

Florida Standards Connections: MAFS.K12.MP.1: Make

sense of problems and persevere in solving them and  
MAFS.K12.MP.2: Reason abstractly and quantitatively.

[SC.912.N.2.1:](#)

Identify what is science, what clearly is not science, and what superficially resembles science (but fails to meet the criteria for science).

**Remarks/Examples:**

Science is the systematic and organized inquiry that is derived from observations and experimentation that can be verified or tested by further investigation to explain natural phenomena (e.g. Science is testable, pseudo-science is not science seeks falsifications, pseudo-science seeks confirmations.)

[SC.912.N.2.2:](#)

Identify which questions can be answered through science and which questions are outside the boundaries of scientific investigation, such as questions addressed by other ways of knowing, such as art, philosophy, and religion.

**Remarks/Examples:**

Identify scientific questions that can be disproved by experimentation/testing. Recognize that pseudoscience is a claim, belief, or practice which is presented as scientific, but does not adhere to strict standards of science (e.g. controlled variables, sample size, replicability, empirical and measurable evidence, and the concept of falsification).

Florida Standards Connections: MAFS.K12.MP.3:  
Construct viable arguments and critique the reasoning of others.

[SC.912.N.2.3:](#)

Identify examples of pseudoscience (such as astrology, phrenology) in society.

**Remarks/Examples:**

Determine if the phenomenon (event) can be observed, measured, and tested through scientific experimentation.

[SC.912.N.2.4:](#)

Explain that scientific knowledge is both durable and robust and open to change. Scientific knowledge can change because it is often examined and re-examined by new investigations and scientific argumentation. Because of these frequent examinations, scientific knowledge becomes stronger, leading to its durability.

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|                                      | <p><b>Remarks/Examples:</b><br/>Recognize that ideas with the most durable explanatory power become established theories, but scientific explanations are continually subjected to change in the face of new evidence.</p> <p>Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them<br/>MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others.</p>   |
| <p><a href="#">SC.912.N.2.5:</a></p> | <p>Describe instances in which scientists' varied backgrounds, talents, interests, and goals influence the inferences and thus the explanations that they make about observations of natural phenomena and describe that competing interpretations (explanations) of scientists are a strength of science as they are a source of new, testable ideas that have the potential to add new evidence to support one or another of the explanations.</p> <p><b>Remarks/Examples:</b><br/>Recognize that scientific questions, observations, and conclusions may be influenced by the existing state of scientific knowledge, the social and cultural context of the researcher, and the observer's experiences and expectations. Identify possible bias in qualitative and quantitative data analysis.</p> |
| <p><a href="#">SC.912.N.3.1:</a></p> | <p>Explain that a scientific theory is the culmination of many scientific investigations drawing together all the current evidence concerning a substantial range of phenomena; thus, a scientific theory represents the most powerful explanation scientists have to offer.</p> <p><b>Remarks/Examples:</b><br/>Explain that a scientific theory is a well-tested hypothesis supported by a preponderance of empirical evidence.</p> <p>Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them and, MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others.</p>   |
| <p><a href="#">SC.912.N.3.2:</a></p> | <p>Describe the role consensus plays in the historical development of a theory in any one of the disciplines of science.</p> <p><b>Remarks/Examples:</b></p>   |

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|                                      | <p>Recognize that scientific argument, disagreement, discourse, and discussion create a broader and more accurate understanding of natural processes and events.</p> <p>Florida Standards Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others.</p>   |
| <p><a href="#">SC.912.N.3.3:</a></p> | <p>Explain that scientific laws are descriptions of specific relationships under given conditions in nature, but do not offer explanations for those relationships.</p> <p><b>Remarks/Examples:</b><br/>Recognize that a scientific theory provides a broad explanation of many observed phenomena while a scientific law describes how something behaves.</p>     |
| <p><a href="#">SC.912.N.3.4:</a></p> | <p>Recognize that theories do not become laws, nor do laws become theories; theories are well supported explanations and laws are well supported descriptions.</p> <p><b>Remarks/Examples:</b><br/>Recognize that theories do not become laws, theories explain laws. Recognize that not all scientific laws have accompanying explanatory theories.</p>           |
| <p><a href="#">SC.912.N.3.5:</a></p> | <p>Describe the function of models in science, and identify the wide range of models used in science.</p> <p><b>Remarks/Examples:</b><br/>Describe how models are used by scientists to explain observations of nature.</p> <p>Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.</p>   |
| <p><a href="#">SC.912.N.4.1:</a></p> | <p>Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making.</p> <p><b>Remarks/Examples:</b><br/>Recognize that no single universal step-by-step scientific method captures the complexity of doing science. A number of shared values and perspectives characterize a scientific approach.</p> |



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|                                       | <p>MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively.</p>  |
| <p><a href="#">SC.912.N.4.2:</a></p>  | <p>Weigh the merits of alternative strategies for solving a specific societal problem by comparing a number of different costs and benefits, such as human, economic, and environmental.</p> <p><b>Remarks/Examples:</b><br/>Identify examples of technologies, objects, and processes that have been modified to advance society, and explain why and how they were modified. Discuss ethics in scientific research to advance society (e.g. global climate change, historical development of medicine and medical practices).</p> <p>Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively.</p> |
| <p><a href="#">SC.912.E.5.9:</a></p>  | <p>Analyze the broad effects of space exploration on the economy and culture of Florida.</p> <p><b>Remarks/Examples:</b><br/>Recognize the economic, technical and social benefits of spinoff technology developed through the space program.</p>   |
| <p><a href="#">SC.912.E.5.10:</a></p> | <p>Describe and apply the coordinate system used to locate objects in the sky.</p> <p><b>Remarks/Examples:</b><br/>Discuss how scientists determine the location of constellations, celestial spheres, and sky maps. Compare and contrast the celestial coordinate system (equatorial system) to the use of latitude and longitude to specify locations on Earth. Recognize the use of right ascension and declination in the location of objects in space, including stars and constellations.</p>   |
| <p><a href="#">SC.912.E.5.7:</a></p>  | <p>Relate the history of and explain the justification for future space exploration and continuing technology development.</p> <p><b>Remarks/Examples:</b><br/>Identify examples of historical space exploration (e.g. telescopes, high altitude balloons, lunar landers, deep-space probes, space station) that had significant impact on</p>  |

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|                                       | <p>current space exploration and recognize the importance of continued exploration in space.</p>   |
| <p><a href="#">SC.912.E.5.8:</a></p>  | <p>Connect the concepts of radiation and the electromagnetic spectrum to the use of historical and newly-developed observational tools.</p> <p><b>Remarks/Examples:</b><br/>Describe how frequency is related to the characteristics of electromagnetic radiation and recognize how spectroscopy is used to detect and interpret information from electromagnetic radiation sources.</p>   |
| <p><a href="#">SC.912.E.5.11:</a></p> | <p>Distinguish the various methods of measuring astronomical distances and apply each in appropriate situations.</p> <p><b>Remarks/Examples:</b><br/>Determine which units of measurement are appropriate to describe distance (e.g. astronomical units, parallax, and light years).</p> <p>Florida Standards Connections: MAFS.K12.MP.5: Use appropriate tools strategically and MAFS.K12.MP.6: Attend to precision.</p>                                  |
| <p><a href="#">SC.912.E.6.2:</a></p>  | <p>Connect surface features to surface processes that are responsible for their formation.</p> <p><b>Remarks/Examples:</b><br/>Identify various landforms (e.g. dunes, lakes, sinkholes, aquifers) and describe how they form (erosion, physical/chemical weathering, and deposition). Explain how sea level changes over time have exposed and inundated continental shelves, created and destroyed inland seas, and shaped the surface of the Earth.</p> |
| <p><a href="#">SC.912.E.7.7:</a></p>  | <p>Identify, analyze, and relate the internal (Earth system) and external (astronomical) conditions that contribute to global climate change.</p> <p><b>Remarks/Examples:</b><br/>Explain the possible natural (e.g. increased global temperature, wildfires, volcanic dust) and anthropogenic mechanisms (e.g. air pollution, acid rain, greenhouse gases, burning of fossil fuels) and the effects of these mechanisms on global climate change.</p>     |

Differentiate among the four states of matter.

[SC.912.P.8.1:](#)

**Remarks/Examples:**

Differentiate among the four states of matter (solid, liquid, gas and plasma) in terms of energy, particle motion, and phase transitions. (Note: Currently five states of matter have been identified.)

Explore the scientific theory of atoms (also known as atomic theory) by describing the structure of atoms in terms of protons, neutrons and electrons, and differentiate among these particles in terms of their mass, electrical charges and locations within the atom.

[SC.912.P.8.4:](#)

**Remarks/Examples:**

Explain that electrons, protons and neutrons are parts of the atom and that the nuclei of atoms are composed of protons and neutrons, which experience forces of attraction and repulsion consistent with their charges and masses.

Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.

Describe the quantization of energy at the atomic level.

[SC.912.P.10.9:](#)

**Remarks/Examples:**

Explain that when electrons transition to higher energy levels they absorb energy, and when they transition to lower energy levels they emit energy. Recognize that spectral lines are the result of transitions of electrons between energy levels that correspond to photons of light with an energy and frequency related to the energy spacing between levels (Planck's relationship  $E = h\nu$ ).

[SC.912.P.10.4:](#)

Describe heat as the energy transferred by convection, conduction, and radiation, and explain the connection of heat to change in temperature or states of matter.

Compare the magnitude and range of the four fundamental forces (gravitational, electromagnetic, weak nuclear, strong nuclear).

[SC.912.P.10.10:](#)

**Remarks/Examples:**

Recognize and discuss the effect of each force on the structure of matter and the evidence for it.

[SC.912.P.10.11:](#)

Explain and compare nuclear reactions (radioactive decay,

fission and fusion), the energy changes associated with them and their associated safety issues.

**Remarks/Examples:**

Identify the three main types of radioactive decay (alpha, beta, and gamma) and compare their properties (composition, mass, charge, and penetrating power). Explain the concept of half-life for an isotope (e.g. C-14 is used to determine the age of objects) and calculate the amount of a radioactive substance remaining after an integral number of half-lives have passed. Recognize that the energy release per gram of material is much larger in nuclear fusion or fission reactions than in chemical reactions due to the large amount of energy related to small amounts of mass by equation  $E=mc^2$ .

Explore the theory of electromagnetism by comparing and contrasting the different parts of the electromagnetic spectrum in terms of wavelength, frequency, and energy, and relate them to phenomena and applications.

[SC.912.P.10.18:](#)

**Remarks/Examples:**

Describe the electromagnetic spectrum (i.e., radio waves, microwaves, infrared, visible light, ultraviolet, X-rays and gamma rays) in terms of frequency, wavelength and energy. Solve problems involving wavelength, frequency, and energy.

[SC.912.P.10.19:](#)

Explain that all objects emit and absorb electromagnetic radiation and distinguish between objects that are blackbody radiators and those that are not.

Describe the measurable properties of waves and explain the relationships among them and how these properties change when the wave moves from one medium to another.

[SC.912.P.10.20:](#)

**Remarks/Examples:**

Describe the measurable properties of waves (velocity, frequency, wavelength, amplitude, period, reflection and refraction) and explain the relationships among them. Recognize that the source of all waves is a vibration and waves carry energy from one place to another. Distinguish between transverse and longitudinal waves in mechanical media, such as springs and ropes, and on the earth (seismic waves). Describe sound as a longitudinal wave whose speed depends on the properties of the medium in

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|  | <p>which it propagates.</p>   |
| <p><a href="#">SC.912.P.10.21:</a></p> | <p>Qualitatively describe the shift in frequency in sound or electromagnetic waves due to the relative motion of a source or a receiver.</p> <p><b>Remarks/Examples:</b></p> <p>Describe the apparent change in frequency of waves due to the motion of a source or a receiver (the Doppler effect).</p>  |
| <p><a href="#">SC.912.P.10.22:</a></p> | <p>Construct ray diagrams and use thin lens and mirror equations to locate the images formed by lenses and mirrors.</p> <p><b>Remarks/Examples:</b></p> <p>Use examples such as converging/diverging lenses and convex/concave mirrors. Use a ray diagram to determine the approximate location and size of the image, and the mirror equation to obtain numerical information about image distance and image size.</p>   |
| <p><a href="#">SC.912.P.12.6:</a></p>  | <p>Qualitatively apply the concept of angular momentum.</p> <p><b>Remarks/Examples:</b></p> <p>Explain that angular momentum is rotational analogy to linear momentum (e.g. Because angular momentum is conserved, a change in the distribution of mass about the axis of rotation will cause a change in the rotational speed [ice skater spinning]).</p>  |
| <p><a href="#">SC.912.P.12.2:</a></p>  | <p>Analyze the motion of an object in terms of its position, velocity, and acceleration (with respect to a frame of reference) as functions of time.</p> <p><b>Remarks/Examples:</b></p> <p>Solve problems involving distance, velocity, speed, and acceleration. Create and interpret graphs of 1-dimensional motion, such as position versus time, distance versus time, speed versus time, velocity versus time, and acceleration versus time where acceleration is constant.</p> <p>Florida Standards Connections: MAFS.912.N-VM.3 (+)<br/>Solve problems involving velocity and other quantities that can be represented by vectors.</p> |
| <p><a href="#">SC.912.P.12.3:</a></p>  | <p>Interpret and apply Newton's three laws of motion.</p>   |

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|                                       | <p><b>Remarks/Examples:</b></p> <p>Explain that when the net force on an object is zero, no acceleration occurs thus, a moving object continues to move at a constant speed in the same direction, or, if at rest, it remains at rest (Newton's first law). Explain that when a net force is applied to an object its motion will change, or accelerate (according to Newton's second law, <math>F = ma</math>). Predict and explain how when one object exerts a force on a second object, the second object always exerts a force of equal magnitude but of opposite direction and force back on the first: <math>F_1 \text{ on } 2 = - F_2 \text{ on } 1</math> (Newton's third law).</p> |
| <p><a href="#">SC.912.P.12.4:</a></p> | <p>Describe how the gravitational force between two objects depends on their masses and the distance between them.</p> <p><b>Remarks/Examples:</b></p> <p>Describe Newton's law of universal gravitation in terms of the attraction between two objects, their masses, and the inverse square of the distance between them.</p>  |
| <p><a href="#">SC.912.P.12.7:</a></p> | <p>Recognize that nothing travels faster than the speed of light in vacuum which is the same for all observers no matter how they or the light source are moving.</p> <p><b>Remarks/Examples:</b></p> <p>Recognize that regardless of the speed of an observer or source, <i>in a vacuum</i> the speed of light is always <math>c</math>.</p>  |
| <p><a href="#">SC.912.P.12.8:</a></p> | <p>Recognize that Newton's Laws are a limiting case of Einstein's Special Theory of Relativity at speeds that are much smaller than the speed of light.</p> <p><b>Remarks/Examples:</b></p> <p>Recognize that the speed of light in any reference frame is the central postulate of the Special Theory of Relativity. As speeds approach zero, Special Relativity tends towards equivalence with Newton's Laws of Motion.</p>  |
| <p><a href="#">SC.912.P.12.9:</a></p> | <p>Recognize that time, length, and energy depend on the frame of reference.</p> <p><b>Remarks/Examples:</b></p> <p>The energy <math>E</math> and the momentum <math>p</math> depend on the frame of reference in which they are measured (e.g. Lorentz</p>  |

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|                                    | contraction).   |
| <a href="#">MAFS.912.N-Q.1.1:</a>  | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. ★   |
| <a href="#">MAFS.912.N-Q.1.3:</a>  | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. ★   |
| <a href="#">MAFS.912.F-IF.2.4:</a> | For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. <i>Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</i> ★   |
| <a href="#">MAFS.912.F-IF.3.7:</a> | Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★ <ul style="list-style-type: none"> <li>a. Graph linear and quadratic functions and show intercepts, maxima, and minima.</li> <li>b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.</li> <li>c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.</li> <li>d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.</li> <li>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.</li> </ul> |
| <a href="#">MAFS.912.G-MG.1.2:</a> | Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). ★   |
| <a href="#">MAFS.912.S-ID.1.1:</a> | Represent data with plots on the real number line (dot plots, histograms, and box plots). ★   |
|                                    | <p><b>Remarks/Examples:</b><br/> In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic</p>  |

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|   | <p>appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.</p>   |
| <p><a href="#">MAFS.912.S-ID.1.2:</a></p> | <p>Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. ★</p> <p><b>Remarks/Examples:</b><br/> In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.</p>   |
| <p><a href="#">MAFS.912.S-ID.1.3:</a></p> | <p>Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). ★</p> <p><b>Remarks/Examples:</b><br/> In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.</p>   |
| <p><a href="#">MAFS.912.S-ID.1.4:</a></p> | <p>Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. ★</p>  |
| <p><a href="#">MAFS.912.S-ID.2.5:</a></p> | <p>Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. ★</p> <p>Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. ★</p> <ol style="list-style-type: none"> <li>Fit a function to the data; use functions fitted to data to solve problems in the context of the data. <i>Use given functions or choose a function suggested by the context. Emphasize linear, and exponential models.</i></li> <li>Informally assess the fit of a function by plotting and analyzing residuals.</li> </ol> |



- c. Fit a linear function for a scatter plot that suggests a linear association.

**Remarks/Examples:**

Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals.

[MAFS.912.S-IC.2.6:](#)

Evaluate reports based on data. ★

Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.

[LAFS.1112.SL.1.1:](#)

- a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.
- b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.
- c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.
- d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task.

[LAFS.1112.SL.1.2:](#)

Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.

[LAFS.1112.SL.1.3:](#)

Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links

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|                                     | among ideas, word choice, points of emphasis, and tone used.  |
| <a href="#">LAFS.1112.SL.2.4:</a>   | Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. |
| <a href="#">LAFS.1112.SL.2.5:</a>   | Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.   |
| <a href="#">LAFS.1112.RST.1.1:</a>  | Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.  |
| <a href="#">LAFS.1112.RST.1.2:</a>  | Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.   |
| <a href="#">LAFS.1112.RST.1.3:</a>  | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.   |
| <a href="#">LAFS.1112.RST.2.4:</a>  | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.  |
| <a href="#">LAFS.1112.RST.2.5:</a>  | Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.   |
| <a href="#">LAFS.1112.RST.2.6:</a>  | Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.   |
| <a href="#">LAFS.1112.RST.3.7:</a>  | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.   |
| <a href="#">LAFS.1112.RST.3.8:</a>  | Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.   |
| <a href="#">LAFS.1112.RST.3.9:</a>  | Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.   |
| <a href="#">LAFS.1112.RST.4.10:</a> | By the end of grade 12, read and comprehend science/technical   |

texts in the grades 11–12 text complexity band independently and proficiently.

Write arguments focused on *discipline-specific content*.

[LAFS.1112.WHST.1.1:](#)

- a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.
- b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience’s knowledge level, concerns, values, and possible biases.
- c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.
- d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
- e. Provide a concluding statement or section that follows from or supports the argument presented.

Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

[LAFS.1112.WHST.1.2:](#)

- a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.
- b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience’s knowledge of the topic.
- c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.
- d. Use precise language, domain-specific vocabulary and

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|                                      | <p>techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.</p> <p>e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic).</p> |
| <a href="#">LAFS.1112.WHST.2.4:</a>  | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.  |
| <a href="#">LAFS.1112.WHST.2.5:</a>  | Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.  |
| <a href="#">LAFS.1112.WHST.2.6:</a>  | Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.  |
| <a href="#">LAFS.1112.WHST.3.7:</a>  | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.  |
| <a href="#">LAFS.1112.WHST.3.8:</a>  | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.             |
| <a href="#">LAFS.1112.WHST.3.9:</a>  | Draw evidence from informational texts to support analysis, reflection, and research.   |
| <a href="#">LAFS.1112.WHST.4.10:</a> | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.  |
| <a href="#">ELD.K12.ELL.1.1:</a>     | English language learners communicate for social and instructional purposes within the school setting.  |
| <a href="#">ELD.K12.ELL.XX.1:</a>    | English language learners communicate information, ideas and concepts necessary for academic success in the content area of Science.  |



## **Biology 1 (#2000310)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 2000310

**Abbreviated Title:** BIO 1

**Number of Credits:** One credit (1)

**Course Length:** Year (Y)

**Course Type:** Core

**Course Level:** 2

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 9,10,11,12

### **GENERAL NOTES**

Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National Science Teachers Association (NSTA) recommends that at the high school level, all students should be in the science lab or field, collecting data every week. School laboratory investigations (labs) are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the high school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (National Research Council, 2006, p.77; NSTA, 2007).

### **Special Notes:**

#### **Instructional Practices**

Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:

1. Ensuring wide reading from complex text that varies in length.
2. Making close reading and rereading of texts central to lessons.
3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.
4. Emphasizing students supporting answers based upon evidence from the text.
5. Providing extensive research and writing opportunities (claims and evidence).

**Science and Engineering Practices** (NRC *Framework for K-12 Science Education, 2010*)

- Asking questions (for science) and defining problems (for engineering).
- Developing and using models.
- Planning and carrying out investigations.
- Analyzing and interpreting data.
- Using mathematics, information and computer technology, and computational thinking.
- Constructing explanations (for science) and designing solutions (for engineering).
- Engaging in argument from evidence.
- Obtaining, evaluating, and communicating information.

**English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Science. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/SC.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

**COURSE STANDARDS**

**Integrate Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

| Name                          | Description   |
|-------------------------------|---|
| <a href="#">SC.912.N.1.1:</a> | Define a problem based on a specific body of knowledge, for |

example: biology, chemistry, physics, and earth/space science, and do the following:

1. **Pose questions about the natural world,** (Articulate the purpose of the investigation and identify the relevant scientific concepts).
2. **Conduct systematic observations,** (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).
3. **Examine books and other sources of information to see what is already known,**
4. **Review what is known in light of empirical evidence,** (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).
5. **Plan investigations,** (Design and evaluate a scientific investigation).
6. **Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),** (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).
7. **Pose answers, explanations, or descriptions of events,**
8. **Generate explanations that explicate or describe natural phenomena (inferences),**
9. **Use appropriate evidence and reasoning to justify these explanations to others,**
10. **Communicate results of scientific investigations, and**
11. **Evaluate the merits of the explanations produced by others.**

**Remarks/Examples:**

Florida Standards Connections for 6-12 Literacy in Science

For Students in Grades 9-10

LAFS.910.RST.1.1 Cite specific textual evidence to support



analysis of science and technical texts, attending to the precise details of explanations or descriptions.

LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.

LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.

For Students in Grades 11-12

LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks analyze the specific results based on explanations in the text.

LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.

Florida Standards Connections for Mathematical Practices

MAFS.K12.MP.1: Make sense of problems and persevere in solving them.  
MAFS.K12.MP.2: Reason abstractly and quantitatively.  
MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]  
MAFS.K12.MP.4: Model with mathematics.  
MAFS.K12.MP.5: Use appropriate tools strategically.  
MAFS.K12.MP.6: Attend to precision.  
MAFS.K12.MP.7: Look for and make use of structure.  
MAFS.K12.MP.8: Look for and express regularity in repeated reasoning.

[SC.912.N.1.3:](#)

Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented.

**Remarks/Examples:**

Assess the reliability of data and identify reasons for inconsistent results, such as sources of error or uncontrolled conditions.

Florida Standards Connections: MAFS.K12.MP.2: Reason abstractly and quantitatively MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others

[SC.912.N.1.4:](#)

Identify sources of information and assess their reliability according to the strict standards of scientific investigation.

**Remarks/Examples:**

Read, interpret, and examine the credibility and validity of scientific claims in different sources of information, such as scientific articles, advertisements, or media stories. Strict standards of science include controlled variables, sufficient sample size, replication of results, empirical and measurable evidence, and the concept of falsification.

Florida Standards Connections: [LAFS.910.RST.1.1](#) / [LAFS.1112.RST.1.1](#).

[SC.912.N.1.6:](#)

Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.

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|                                      | <p><b>Remarks/Examples:</b><br/>Collect data/evidence and use tables/graphs to draw conclusions and make inferences based on patterns or trends in the data.</p> <p>Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them.</p>  |
| <p><a href="#">SC.912.N.2.1:</a></p> | <p>Identify what is science, what clearly is not science, and what superficially resembles science (but fails to meet the criteria for science).</p> <p><b>Remarks/Examples:</b><br/>Science is the systematic and organized inquiry that is derived from observations and experimentation that can be verified or tested by further investigation to explain natural phenomena (e.g. Science is testable, pseudo-science is not science seeks falsifications, pseudo-science seeks confirmations.)</p>  |
| <p><a href="#">SC.912.N.2.2:</a></p> | <p>Identify which questions can be answered through science and which questions are outside the boundaries of scientific investigation, such as questions addressed by other ways of knowing, such as art, philosophy, and religion.</p> <p><b>Remarks/Examples:</b><br/>Identify scientific questions that can be disproved by experimentation/testing. Recognize that pseudoscience is a claim, belief, or practice which is presented as scientific, but does not adhere to strict standards of science (e.g. controlled variables, sample size, replicability, empirical and measurable evidence, and the concept of falsification).</p> <p>Florida Standards Connections: MAFS.K12.MP.3:<br/>Construct viable arguments and critique the reasoning of others.</p> |
| <p><a href="#">SC.912.N.3.1:</a></p> | <p>Explain that a scientific theory is the culmination of many scientific investigations drawing together all the current evidence concerning a substantial range of phenomena; thus, a scientific theory represents the most powerful explanation scientists have to offer.</p> <p><b>Remarks/Examples:</b><br/>Explain that a scientific theory is a well-tested hypothesis supported by a preponderance of empirical evidence.</p>  |

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|                                       | <p>Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them and, MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others.</p>   |
| <p><a href="#">SC.912.N.3.4:</a></p>  | <p>Recognize that theories do not become laws, nor do laws become theories; theories are well supported explanations and laws are well supported descriptions.</p> <p><b>Remarks/Examples:</b><br/>Recognize that theories do not become laws, theories explain laws. Recognize that not all scientific laws have accompanying explanatory theories.</p>   |
| <p><a href="#">SC.912.E.7.1:</a></p>  | <p>Analyze the movement of matter and energy through the different biogeochemical cycles, including water and carbon.</p> <p><b>Remarks/Examples:</b><br/>Describe that the Earth system contains fixed amounts of each stable chemical element and that each element moves among reservoirs in the solid earth, oceans, atmosphere and living organisms as part of biogeochemical cycles (i.e., nitrogen, water, carbon, oxygen and phosphorus), which are driven by energy from within the Earth and from the Sun.</p> |
| <p><a href="#">SC.912.L.14.4:</a></p> | <p>Compare and contrast structure and function of various types of microscopes.</p>  |
| <p><a href="#">SC.912.L.14.1:</a></p> | <p>Describe the scientific theory of cells (cell theory) and relate the history of its discovery to the process of science.</p> <p><b>Remarks/Examples:</b><br/>Describe how continuous investigations and/or new scientific information influenced the development of the cell theory. Recognize the contributions of scientists in the development of the cell theory.</p>   |
| <p><a href="#">SC.912.L.14.2:</a></p> | <p>Relate structure to function for the components of plant and animal cells. Explain the role of cell membranes as a highly selective barrier (passive and active transport).</p>   |
| <p><a href="#">SC.912.L.14.3:</a></p> | <p>Compare and contrast the general structures of plant and animal cells. Compare and contrast the general structures of prokaryotic and eukaryotic cells.</p> <p><b>Remarks/Examples:</b></p>   |

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|                                 | Annually Assessed on Biology EOC. Also assesses <a href="#">SC.912.L.14.2</a> .   |
| <a href="#">SC.912.L.14.6:</a>  | Explain the significance of genetic factors, environmental factors, and pathogenic agents to health from the perspectives of both individual and public health.   |
| <a href="#">SC.912.L.14.7:</a>  | Relate the structure of each of the major plant organs and tissues to physiological processes.<br><br><b>Remarks/Examples:</b><br>Annually Assessed on Biology EOC.   |
| <a href="#">SC.912.L.14.26:</a> | Identify the major parts of the brain on diagrams or models.<br><br><b>Remarks/Examples:</b><br>Annually Assessed on Biology EOC.<br>Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.  |
| <a href="#">SC.912.L.14.36:</a> | Describe the factors affecting blood flow through the cardiovascular system.  |
| <a href="#">SC.912.L.14.52:</a> | Explain the basic functions of the human immune system, including specific and nonspecific immune response, vaccines, and antibiotics.<br><br><b>Remarks/Examples:</b><br>Annually Assessed on Biology EOC. Also assesses <a href="#">SC.912.L.14.6</a> <a href="#">HE.912.C.1.7</a> and <a href="#">HE.912.C.1.5</a> .   |
| <a href="#">SC.912.L.15.1:</a>  | Explain how the scientific theory of evolution is supported by the fossil record, comparative anatomy, comparative embryology, biogeography, molecular biology, and observed evolutionary change.<br><br><b>Remarks/Examples:</b><br>Annually Assessed on Biology EOC. Also assesses <a href="#">SC.912.L.15.10</a> <a href="#">SC.912.N.1.3</a> <a href="#">SC.912.N.1.4</a> <a href="#">SC.912.N.1.6</a> <a href="#">SC.912.N.2.1</a> <a href="#">SC.912.N.3.1</a> and <a href="#">SC.912.N.3.4</a> . |
| <a href="#">SC.912.L.15.4:</a>  | Describe how and why organisms are hierarchically classified and based on evolutionary relationships.   |
| <a href="#">SC.912.L.15.5:</a>  | Explain the reasons for changes in how organisms are classified.  |
| <a href="#">SC.912.L.15.6:</a>  | Discuss distinguishing characteristics of the domains and kingdoms of living organisms.   |

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|                                 | <p><b>Remarks/Examples:</b></p> <p>Annually Assessed on Biology EOC. Also assesses <a href="#">SC.912.L.15.4</a> <a href="#">SC.912.L.15.5</a> <a href="#">SC.912.N.1.3</a> and <a href="#">SC.912.N.1.6</a>.</p>  |
| <a href="#">SC.912.L.15.8:</a>  | <p>Describe the scientific explanations of the origin of life on Earth.</p> <p><b>Remarks/Examples:</b></p> <p>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.N.1.3</a>, <a href="#">SC.912.N.1.4</a>, and <a href="#">SC.912.N.2.1</a>.</p>   |
| <a href="#">SC.912.L.15.10:</a> | <p>Identify basic trends in hominid evolution from early ancestors six million years ago to modern humans, including brain size, jaw size, language, and manufacture of tools.</p>   |
| <a href="#">SC.912.L.15.13:</a> | <p>Describe the conditions required for natural selection, including: overproduction of offspring, inherited variation, and the struggle to survive, which result in differential reproductive success.</p> <p><b>Remarks/Examples:</b></p> <p>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.15.14</a>, <a href="#">SC.912.L.15.15</a>, and <a href="#">SC.912.N.1.3</a>.</p> |
| <a href="#">SC.912.L.15.14:</a> | <p>Discuss mechanisms of evolutionary change other than natural selection such as genetic drift and gene flow.</p>   |
| <a href="#">SC.912.L.15.15:</a> | <p>Describe how mutation and genetic recombination increase genetic variation.</p>   |
| <a href="#">SC.912.L.16.1:</a>  | <p>Use Mendel's laws of segregation and independent assortment to analyze patterns of inheritance.</p> <p><b>Remarks/Examples:</b></p> <p>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.16.2</a>.</p>   |
| <a href="#">SC.912.L.16.2:</a>  | <p>Discuss observed inheritance patterns caused by various modes of inheritance, including dominant, recessive, codominant, sex-linked, polygenic, and multiple alleles.</p>   |
| <a href="#">SC.912.L.16.9:</a>  | <p>Explain how and why the genetic code is universal and is common to almost all organisms.</p>  |
| <a href="#">SC.912.L.16.3:</a>  | <p>Describe the basic process of DNA replication and how it relates to the transmission and conservation of the genetic information.</p> <p><b>Remarks/Examples:</b></p> <p>Integrate <a href="#">HE.912.C.1.7</a>. Analyze how heredity and family</p>  |

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|                                 | <p>history can impact personal health. Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.16.4</a> <a href="#">SC.912.L.16.5</a> <a href="#">SC.912.L.16.9</a>.</p>   |
| <a href="#">SC.912.L.16.4:</a>  | <p>Explain how mutations in the DNA sequence may or may not result in phenotypic change. Explain how mutations in gametes may result in phenotypic changes in offspring.</p>  |
| <a href="#">SC.912.L.16.5:</a>  | <p>Explain the basic processes of transcription and translation, and how they result in the expression of genes.</p>  |
| <a href="#">SC.912.L.16.8:</a>  | <p>Explain the relationship between mutation, cell cycle, and uncontrolled cell growth potentially resulting in cancer.</p> <p><b>Remarks/Examples:</b><br/>Integrate <a href="#">HE.912.C.1.7</a>. Analyze how heredity and family history can impact personal health.</p>                 |
| <a href="#">SC.912.L.16.10:</a> | <p>Evaluate the impact of biotechnology on the individual, society and the environment, including medical and ethical issues.</p> <p><b>Remarks/Examples:</b><br/>Annually assessed on Biology EOC.</p>   |
| <a href="#">SC.912.L.16.13:</a> | <p>Describe the basic anatomy and physiology of the human reproductive system. Describe the process of human development from fertilization to birth and major changes that occur in each trimester of pregnancy.</p> <p><b>Remarks/Examples:</b><br/>Annually assessed on Biology EOC.</p> |
| <a href="#">SC.912.L.16.14:</a> | <p>Describe the cell cycle, including the process of mitosis. Explain the role of mitosis in the formation of new cells and its importance in maintaining chromosome number during asexual reproduction.</p>  |
| <a href="#">SC.912.L.16.16:</a> | <p>Describe the process of meiosis, including independent assortment and crossing over. Explain how reduction division results in the formation of haploid gametes or spores.</p>   |
| <a href="#">SC.912.L.16.17:</a> | <p>Compare and contrast mitosis and meiosis and relate to the processes of sexual and asexual reproduction and their consequences for genetic variation.</p> <p><b>Remarks/Examples:</b><br/>Annually assessed on Biology EOC. Also assesses</p>  |

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|                                 | <a href="#">SC.912.L.16.8</a> <a href="#">SC.912.L.16.14</a> <a href="#">SC.912.L.16.16</a> .   |
| <a href="#">SC.912.L.17.2:</a>  | Explain the general distribution of life in aquatic systems as a function of chemistry, geography, light, depth, salinity, and temperature.   |
| <a href="#">SC.912.L.17.4:</a>  | Describe changes in ecosystems resulting from seasonal variations, climate change and succession.   |
| <a href="#">SC.912.L.17.5:</a>  | Analyze how population size is determined by births, deaths, immigration, emigration, and limiting factors (biotic and abiotic) that determine carrying capacity.<br><br><b>Remarks/Examples:</b><br>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.17.2</a> <a href="#">SC.912.L.17.4</a> <a href="#">SC.912.L.17.8</a> <a href="#">SC.912.N.1.4</a> . |
| <a href="#">SC.912.L.17.8:</a>  | Recognize the consequences of the losses of biodiversity due to catastrophic events, climate changes, human activity, and the introduction of invasive, non-native species.   |
| <a href="#">SC.912.L.17.9:</a>  | Use a food web to identify and distinguish producers, consumers, and decomposers. Explain the pathway of energy transfer through trophic levels and the reduction of available energy at successive trophic levels.<br><br><b>Remarks/Examples:</b><br>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.E.7.1</a> .   |
| <a href="#">SC.912.L.17.11:</a> | Evaluate the costs and benefits of renewable and nonrenewable resources, such as water, energy, fossil fuels, wildlife, and forests.  |
| <a href="#">SC.912.L.17.13:</a> | Discuss the need for adequate monitoring of environmental parameters when making policy decisions.  |
| <a href="#">SC.912.L.17.20:</a> | Predict the impact of individuals on environmental systems and examine how human lifestyles affect sustainability.<br><br><b>Remarks/Examples:</b><br>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.17.11</a> , <a href="#">SC.912.L.17.13</a> , <a href="#">SC.912.N.1.3</a> .  |
| <a href="#">SC.912.L.18.1:</a>  | Describe the basic molecular structures and primary functions of the four major categories of biological macromolecules.<br><br><b>Remarks/Examples:</b>  |



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|                                   | Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.18.11</a> .  |
| <a href="#">SC.912.L.18.7:</a>    | Identify the reactants, products, and basic functions of photosynthesis.  |
| <a href="#">SC.912.L.18.8:</a>    | Identify the reactants, products, and basic functions of aerobic and anaerobic cellular respiration.  |
| <a href="#">SC.912.L.18.9:</a>    | Explain the interrelated nature of photosynthesis and cellular respiration.<br><br><b>Remarks/Examples:</b><br>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.18.7</a> <a href="#">SC.912.L.18.8</a> <a href="#">SC.912.L.18.10</a> .   |
| <a href="#">SC.912.L.18.10:</a>   | Connect the role of adenosine triphosphate (ATP) to energy transfers within a cell.   |
| <a href="#">SC.912.L.18.11:</a>   | Explain the role of enzymes as catalysts that lower the activation energy of biochemical reactions. Identify factors, such as pH and temperature, and their effect on enzyme activity.  |
| <a href="#">SC.912.L.18.12:</a>   | Discuss the special properties of water that contribute to Earth's suitability as an environment for life: cohesive behavior, ability to moderate temperature, expansion upon freezing, and versatility as a solvent.<br><br><b>Remarks/Examples:</b><br>Annually assessed on Biology EOC.  |
| <a href="#">MAFS.912.N-Q.1.1:</a> | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. ★   |
| <a href="#">MAFS.912.N-Q.1.3:</a> | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. ★   |
| <a href="#">LAFS.910.SL.1.1:</a>  | Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.<br><br>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.<br><br>b. Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes |

- on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed.
- c. Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.
  - d. Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.

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| <a href="#">LAFS.910.SL.1.2:</a>  | Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.  |
| <a href="#">LAFS.910.SL.1.3:</a>  | Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.   |
| <a href="#">LAFS.910.SL.2.4:</a>  | Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task. |
| <a href="#">LAFS.910.SL.2.5:</a>  | Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.   |
| <a href="#">LAFS.910.RST.1.1:</a> | Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.  |
| <a href="#">LAFS.910.RST.1.2:</a> | Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.  |
| <a href="#">LAFS.910.RST.1.3:</a> | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.   |
| <a href="#">LAFS.910.RST.2.4:</a> | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.   |
| <a href="#">LAFS.910.RST.2.5:</a> | Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).   |

[LAFS.910.RST.2.6:](#)

Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.

[LAFS.910.RST.3.7:](#)

Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

[LAFS.910.RST.3.8:](#)

Assess the extent to which the reasoning and evidence in a text support the author’s claim or a recommendation for solving a scientific or technical problem.

[LAFS.910.RST.3.9:](#)

Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.

[LAFS.910.RST.4.10:](#)

By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.

[LAFS.910.WHST.1.1:](#)

Write arguments focused on *discipline-specific content*.

- a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.
- b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience’s knowledge level and concerns.
- c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.
- d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
- e. Provide a concluding statement or section that follows from or supports the argument presented.

[LAFS.910.WHST.1.2:](#)

Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

- a. Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics

(e.g., figures, tables), and multimedia when useful to aiding comprehension.

- b. Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.
- c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts.
- d. Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.
- e. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
- f. Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).

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| <a href="#">LAFS.910.WHST.2.4:</a> | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.  |
| <a href="#">LAFS.910.WHST.2.5:</a> | Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.  |
| <a href="#">LAFS.910.WHST.2.6:</a> | Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.  |
| <a href="#">LAFS.910.WHST.3.7:</a> | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.  |
| <a href="#">LAFS.910.WHST.3.8:</a> | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation. |
| <a href="#">LAFS.910.WHST.3.9:</a> | Draw evidence from informational texts to support analysis, reflection, and research.   |

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| <a href="#">LAFS.910.WHST.4.10:</a> | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.   |
| <a href="#">HE.912.C.1.3:</a>       | Evaluate how environment and personal health are interrelated.<br><br><b>Remarks/Examples:</b><br>Food options within a community; prenatal-care services; availability of recreational facilities; air quality; weather-safety awareness; and weather, air, and water conditions. |
| <a href="#">HE.912.C.1.5:</a>       | Analyze strategies for prevention, detection, and treatment of communicable and chronic diseases.<br><br><b>Remarks/Examples:</b><br>Health prevention, detection, and treatment of: breast and testicular cancer, suicide, obesity, and industrial-related chronic disease.       |
| <a href="#">HE.912.C.1.7:</a>       | Analyze how heredity and family history can impact personal health.<br><br><b>Remarks/Examples:</b><br>Drug use, family obesity, heart disease, mental health, and non-communicable illness or disease.  |
| <a href="#">ELD.K12.ELL.1.1:</a>    | English language learners communicate for social and instructional purposes within the school setting.   |
| <a href="#">ELD.K12.ELL.XX.1:</a>   | English language learners communicate information, ideas and concepts necessary for academic success in the content area of Science.   |

## **Biology 1 Honors (#2000320)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 2000320

**Abbreviated Title:** BIO 1 HON

**Number of Credits:** One credit (1)

**Course Length:** Year (Y)

**Honors?** Yes

**Course Type:** Core

**Course Level:** 3

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 9,10,11,12

### **GENERAL NOTES**

While the content focus of this course is consistent with the Biology I course, students will explore these concepts in greater depth. In general, the academic pace and rigor will be greatly increased for honors level course work. Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National Science Teachers Association (NSTA) recommends that at the high school level, all students should be in the science lab or field, collecting data every week. School laboratory investigations (labs) are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the high school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (National Research Council, 2006, p.77; NSTA, 2007).

### **Special Notes:**

#### **Instructional Practices**

Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:

1. Ensuring wide reading from complex text that varies in length.
2. Making close reading and rereading of texts central to lessons.
3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.
4. Emphasizing students supporting answers based upon evidence from the text.
5. Providing extensive research and writing opportunities (claims and evidence).

**Science and Engineering Practices** (NRC *Framework for K-12 Science Education, 2010*)

- Asking questions (for science) and defining problems (for engineering).
- Developing and using models.
- Planning and carrying out investigations.
- Analyzing and interpreting data.
- Using mathematics, information and computer technology, and computational thinking.
- Constructing explanations (for science) and designing solutions (for engineering).
- Engaging in argument from evidence.
- Obtaining, evaluating, and communicating information.

**English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Science. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/SC.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

**COURSE STANDARDS**

**Integrate Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

| Name                                 | Description   |
|--------------------------------------|---|
| <p><a href="#">SC.912.N.1.1:</a></p> | <p>Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:</p> <ol style="list-style-type: none"> <li>1. <b>Pose questions about the natural world,</b> (Articulate the purpose of the investigation and identify the relevant scientific concepts).</li> <li>2. <b>Conduct systematic observations,</b> (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).</li> <li>3. <b>Examine books and other sources of information to see what is already known,</b></li> <li>4. <b>Review what is known in light of empirical evidence,</b> (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).</li> <li>5. <b>Plan investigations,</b> (Design and evaluate a scientific investigation).</li> <li>6. <b>Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),</b> (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).</li> <li>7. <b>Pose answers, explanations, or descriptions of events,</b></li> <li>8. <b>Generate explanations that explicate or describe natural phenomena (inferences),</b></li> <li>9. <b>Use appropriate evidence and reasoning to justify these explanations to others,</b></li> <li>10. <b>Communicate results of scientific investigations, and</b></li> <li>11. <b>Evaluate the merits of the explanations produced by others.</b></li> </ol> <div style="border: 1px solid black; padding: 10px; margin-top: 20px;"> <p><b>Remarks/Examples:</b></p> <p>Florida Standards Connections for 6-12 Literacy in Science</p> </div> |



For Students in Grades 9-10

LAFS.910.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.

LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.

For Students in Grades 11-12

LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks analyze the specific results based on explanations in the text.

LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.

Florida Standards Connections for Mathematical Practices

MAFS.K12.MP.1: Make sense of problems and persevere in solving them.

MAFS.K12.MP.2: Reason abstractly and quantitatively.

MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]

MAFS.K12.MP.4: Model with mathematics.

MAFS.K12.MP.5: Use appropriate tools strategically.

MAFS.K12.MP.6: Attend to precision.

MAFS.K12.MP.7: Look for and make use of structure.

MAFS.K12.MP.8: Look for and express regularity in repeated reasoning.

[SC.912.N.1.3:](#)

Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented.

**Remarks/Examples:**

Assess the reliability of data and identify reasons for inconsistent results, such as sources of error or uncontrolled conditions.

Florida Standards Connections: MAFS.K12.MP.2: Reason abstractly and quantitatively MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others

[SC.912.N.1.4:](#)

Identify sources of information and assess their reliability according to the strict standards of scientific investigation.

**Remarks/Examples:**

Read, interpret, and examine the credibility and validity of scientific claims in different sources of information, such as scientific articles, advertisements, or media stories. Strict standards of science include controlled variables, sufficient sample size, replication of results, empirical and measurable evidence, and the concept of falsification.

Florida Standards Connections: [LAFS.910.RST.1.1](#) / [LAFS.1112.RST.1.1](#).

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| <p><a href="#">SC.912.N.1.6:</a></p> | <p>Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.</p> <p><b>Remarks/Examples:</b><br/>Collect data/evidence and use tables/graphs to draw conclusions and make inferences based on patterns or trends in the data.</p> <p>Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them.</p>  |
| <p><a href="#">SC.912.N.2.1:</a></p> | <p>Identify what is science, what clearly is not science, and what superficially resembles science (but fails to meet the criteria for science).</p> <p><b>Remarks/Examples:</b><br/>Science is the systematic and organized inquiry that is derived from observations and experimentation that can be verified or tested by further investigation to explain natural phenomena (e.g. Science is testable, pseudo-science is not science seeks falsifications, pseudo-science seeks confirmations.)</p>  |
| <p><a href="#">SC.912.N.2.2:</a></p> | <p>Identify which questions can be answered through science and which questions are outside the boundaries of scientific investigation, such as questions addressed by other ways of knowing, such as art, philosophy, and religion.</p> <p><b>Remarks/Examples:</b><br/>Identify scientific questions that can be disproved by experimentation/testing. Recognize that pseudoscience is a claim, belief, or practice which is presented as scientific, but does not adhere to strict standards of science (e.g. controlled variables, sample size, replicability, empirical and measurable evidence, and the concept of falsification).</p> <p>Florida Standards Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others.</p> |
| <p><a href="#">SC.912.N.2.4:</a></p> | <p>Explain that scientific knowledge is both durable and robust and open to change. Scientific knowledge can change because it is often examined and re-examined by new investigations and scientific argumentation. Because of these frequent examinations, scientific knowledge becomes stronger, leading to its durability.</p>   |

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|                                      | <p><b>Remarks/Examples:</b><br/>Recognize that ideas with the most durable explanatory power become established theories, but scientific explanations are continually subjected to change in the face of new evidence.</p> <p>Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them<br/>MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others.</p>   |
| <p><a href="#">SC.912.N.3.1:</a></p> | <p>Explain that a scientific theory is the culmination of many scientific investigations drawing together all the current evidence concerning a substantial range of phenomena; thus, a scientific theory represents the most powerful explanation scientists have to offer.</p> <p><b>Remarks/Examples:</b><br/>Explain that a scientific theory is a well-tested hypothesis supported by a preponderance of empirical evidence.</p> <p>Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them and,<br/>MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others.</p> |
| <p><a href="#">SC.912.N.3.4:</a></p> | <p>Recognize that theories do not become laws, nor do laws become theories; theories are well supported explanations and laws are well supported descriptions.</p> <p><b>Remarks/Examples:</b><br/>Recognize that theories do not become laws, theories explain laws. Recognize that not all scientific laws have accompanying explanatory theories.</p>   |
| <p><a href="#">SC.912.E.7.1:</a></p> | <p>Analyze the movement of matter and energy through the different biogeochemical cycles, including water and carbon.</p> <p><b>Remarks/Examples:</b><br/>Describe that the Earth system contains fixed amounts of each stable chemical element and that each element moves among reservoirs in the solid earth, oceans, atmosphere and living organisms as part of biogeochemical cycles (i.e., nitrogen, water, carbon, oxygen and phosphorus), which are driven by energy from within the Earth and from the Sun.</p>   |

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| <p><a href="#">SC.912.P.8.7:</a></p>  | <p>Interpret formula representations of molecules and compounds in terms of composition and structure.</p> <p><b>Remarks/Examples:</b><br/>Write chemical formulas for simple covalent (HCl, SO<sub>2</sub>, CO<sub>2</sub>, and CH<sub>4</sub>), ionic (Na<sup>+</sup> + Cl<sup>-</sup> → NaCl) and molecular (O<sub>2</sub>, H<sub>2</sub>O) compounds. Predict the formulas of ionic compounds based on the number of valence electrons and the charges on the ions.</p>   |
| <p><a href="#">SC.912.P.10.1:</a></p> | <p>Differentiate among the various forms of energy and recognize that they can be transformed from one form to others.</p> <p><b>Remarks/Examples:</b><br/>Differentiate between kinetic and potential energy. Recognize that energy cannot be created or destroyed, only transformed. Identify examples of transformation of energy: Heat to light in incandescent electric light bulbs<br/>Light to heat in laser drills<br/>Electrical to sound in radios<br/>Sound to electrical in microphones<br/>Electrical to chemical in battery rechargers<br/>Chemical to electrical in dry cells<br/>Mechanical to electrical in generators [power plants]<br/>Nuclear to heat in nuclear reactors<br/>Gravitational potential energy of a falling object is converted to kinetic energy then to heat and sound energy when the object hits the ground.</p> |
| <p><a href="#">SC.912.L.14.4:</a></p> | <p>Compare and contrast structure and function of various types of microscopes.</p>   |
| <p><a href="#">SC.912.L.14.1:</a></p> | <p>Describe the scientific theory of cells (cell theory) and relate the history of its discovery to the process of science.</p> <p><b>Remarks/Examples:</b><br/>Describe how continuous investigations and/or new scientific information influenced the development of the cell theory. Recognize the contributions of scientists in the development of the cell theory.</p>  |
| <p><a href="#">SC.912.L.14.2:</a></p> | <p>Relate structure to function for the components of plant and animal cells. Explain the role of cell membranes as a highly selective barrier (passive and active transport).</p>  |
| <p><a href="#">SC.912.L.14.3:</a></p> | <p>Compare and contrast the general structures of plant and animal cells. Compare and contrast the general structures of prokaryotic and eukaryotic cells.</p> <p><b>Remarks/Examples:</b></p>  |

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|  | <p>Annually Assessed on Biology EOC. Also assesses <a href="#">SC.912.L.14.2</a>.</p>   |
| <p><a href="#">SC.912.L.14.5:</a></p>  | <p>Explain the evidence supporting the scientific theory of the origin of eukaryotic cells (endosymbiosis).</p>   |
| <p><a href="#">SC.912.L.14.6:</a></p>  | <p>Explain the significance of genetic factors, environmental factors, and pathogenic agents to health from the perspectives of both individual and public health.</p>  |
| <p><a href="#">SC.912.L.14.7:</a></p>  | <p>Relate the structure of each of the major plant organs and tissues to physiological processes.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Annually Assessed on Biology EOC.</p> </div>  |
| <p><a href="#">SC.912.L.14.26:</a></p> | <p>Identify the major parts of the brain on diagrams or models.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Annually Assessed on Biology EOC.<br/>Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.</p> </div>  |
| <p><a href="#">SC.912.L.14.27:</a></p> | <p>Identify the functions of the major parts of the brain, including the meninges, medulla, pons, midbrain, hypothalamus, thalamus, cerebellum and cerebrum.</p>  |
| <p><a href="#">SC.912.L.14.36:</a></p> | <p>Describe the factors affecting blood flow through the cardiovascular system.</p>   |
| <p><a href="#">SC.912.L.14.52:</a></p> | <p>Explain the basic functions of the human immune system, including specific and nonspecific immune response, vaccines, and antibiotics.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Annually Assessed on Biology EOC. Also assesses <a href="#">SC.912.L.14.6</a> <a href="#">HE.912.C.1.7</a> and <a href="#">HE.912.C.1.5</a>.</p> </div>   |
| <p><a href="#">SC.912.L.15.1:</a></p>  | <p>Explain how the scientific theory of evolution is supported by the fossil record, comparative anatomy, comparative embryology, biogeography, molecular biology, and observed evolutionary change.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Annually Assessed on Biology EOC. Also assesses <a href="#">SC.912.L.15.10</a> <a href="#">SC.912.N.1.3</a> <a href="#">SC.912.N.1.4</a> <a href="#">SC.912.N.1.6</a> <a href="#">SC.912.N.2.1</a> <a href="#">SC.912.N.3.1</a> and <a href="#">SC.912.N.3.4</a>.</p> </div> |

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| <a href="#">SC.912.L.15.2:</a>  | Discuss the use of molecular clocks to estimate how long ago various groups of organisms diverged evolutionarily from one another.   |
| <a href="#">SC.912.L.15.3:</a>  | Describe how biological diversity is increased by the origin of new species and how it is decreased by the natural process of extinction.  |
| <a href="#">SC.912.L.15.4:</a>  | Describe how and why organisms are hierarchically classified and based on evolutionary relationships.  |
| <a href="#">SC.912.L.15.5:</a>  | Explain the reasons for changes in how organisms are classified.<br>Discuss distinguishing characteristics of the domains and kingdoms of living organisms.  |
| <a href="#">SC.912.L.15.6:</a>  | <p><b>Remarks/Examples:</b></p> <p>Annually Assessed on Biology EOC. Also assesses <a href="#">SC.912.L.15.4</a> <a href="#">SC.912.L.15.5</a> <a href="#">SC.912.N.1.3</a> and <a href="#">SC.912.N.1.6</a>.</p>  |
| <a href="#">SC.912.L.15.8:</a>  | Describe the scientific explanations of the origin of life on Earth.<br><p><b>Remarks/Examples:</b></p> <p>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.N.1.3</a>, <a href="#">SC.912.N.1.4</a>, and <a href="#">SC.912.N.2.1</a>.</p>   |
| <a href="#">SC.912.L.15.10:</a> | Identify basic trends in hominid evolution from early ancestors six million years ago to modern humans, including brain size, jaw size, language, and manufacture of tools.  |
| <a href="#">SC.912.L.15.13:</a> | Describe the conditions required for natural selection, including: overproduction of offspring, inherited variation, and the struggle to survive, which result in differential reproductive success.<br><p><b>Remarks/Examples:</b></p> <p>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.15.14</a>, <a href="#">SC.912.L.15.15</a>, and <a href="#">SC.912.N.1.3</a>.</p> |
| <a href="#">SC.912.L.15.14:</a> | Discuss mechanisms of evolutionary change other than natural selection such as genetic drift and gene flow.  |
| <a href="#">SC.912.L.15.15:</a> | Describe how mutation and genetic recombination increase genetic variation.  |
| <a href="#">SC.912.L.16.1:</a>  | Use Mendel's laws of segregation and independent assortment to analyze patterns of inheritance.<br><p><b>Remarks/Examples:</b></p> <p>Annually assessed on Biology EOC. Also assesses</p>  |

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|                                 | <a href="#">SC.912.L.16.2.</a>  |
| <a href="#">SC.912.L.16.2:</a>  | Discuss observed inheritance patterns caused by various modes of inheritance, including dominant, recessive, codominant, sex-linked, polygenic, and multiple alleles.   |
| <a href="#">SC.912.L.16.9:</a>  | Explain how and why the genetic code is universal and is common to almost all organisms.  |
| <a href="#">SC.912.L.16.15:</a> | Compare and contrast binary fission and mitotic cell division.  |
|                                 | Describe the basic process of DNA replication and how it relates to the transmission and conservation of the genetic information.   |
| <a href="#">SC.912.L.16.3:</a>  | <p><b>Remarks/Examples:</b></p> <p>Integrate <a href="#">HE.912.C.1.7</a>. Analyze how heredity and family history can impact personal health. Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.16.4</a> <a href="#">SC.912.L.16.5</a> <a href="#">SC.912.L.16.9</a>.</p> |
| <a href="#">SC.912.L.16.4:</a>  | Explain how mutations in the DNA sequence may or may not result in phenotypic change. Explain how mutations in gametes may result in phenotypic changes in offspring.   |
| <a href="#">SC.912.L.16.5:</a>  | Explain the basic processes of transcription and translation, and how they result in the expression of genes.   |
|                                 | Explain the relationship between mutation, cell cycle, and uncontrolled cell growth potentially resulting in cancer.  |
| <a href="#">SC.912.L.16.8:</a>  | <p><b>Remarks/Examples:</b></p> <p>Integrate <a href="#">HE.912.C.1.7</a>. Analyze how heredity and family history can impact personal health.</p>  |
|                                 | Evaluate the impact of biotechnology on the individual, society and the environment, including medical and ethical issues.  |
| <a href="#">SC.912.L.16.10:</a> | <p><b>Remarks/Examples:</b></p> <p>Annually assessed on Biology EOC.</p>  |
| <a href="#">SC.912.L.16.12:</a> | Describe how basic DNA technology (restriction digestion by endonucleases, gel electrophoresis, polymerase chain reaction, ligation, and transformation) is used to construct recombinant DNA molecules (DNA cloning).  |
| <a href="#">SC.912.L.16.13:</a> | Describe the basic anatomy and physiology of the human reproductive system. Describe the process of human development from fertilization to birth and major changes that occur in each trimester of pregnancy.  |



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|                                 | <p><b>Remarks/Examples:</b><br/>Annually assessed on Biology EOC.</p>   |
| <a href="#">SC.912.L.16.14:</a> | Describe the cell cycle, including the process of mitosis. Explain the role of mitosis in the formation of new cells and its importance in maintaining chromosome number during asexual reproduction.               |
| <a href="#">SC.912.L.16.16:</a> | Describe the process of meiosis, including independent assortment and crossing over. Explain how reduction division results in the formation of haploid gametes or spores.  |
| <a href="#">SC.912.L.16.17:</a> | Compare and contrast mitosis and meiosis and relate to the processes of sexual and asexual reproduction and their consequences for genetic variation.   |
|                                 | <p><b>Remarks/Examples:</b><br/>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.16.8</a> <a href="#">SC.912.L.16.14</a> <a href="#">SC.912.L.16.16</a>.</p>                                    |
| <a href="#">SC.912.L.17.2:</a>  | Explain the general distribution of life in aquatic systems as a function of chemistry, geography, light, depth, salinity, and temperature.   |
| <a href="#">SC.912.L.17.4:</a>  | Describe changes in ecosystems resulting from seasonal variations, climate change and succession.   |
| <a href="#">SC.912.L.17.5:</a>  | Analyze how population size is determined by births, deaths, immigration, emigration, and limiting factors (biotic and abiotic) that determine carrying capacity.   |
|                                 | <p><b>Remarks/Examples:</b><br/>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.17.2</a> <a href="#">SC.912.L.17.4</a> <a href="#">SC.912.L.17.8</a> <a href="#">SC.912.N.1.4</a>.</p>         |
| <a href="#">SC.912.L.17.8:</a>  | Recognize the consequences of the losses of biodiversity due to catastrophic events, climate changes, human activity, and the introduction of invasive, non-native species.   |
| <a href="#">SC.912.L.17.9:</a>  | Use a food web to identify and distinguish producers, consumers, and decomposers. Explain the pathway of energy transfer through trophic levels and the reduction of available energy at successive trophic levels. |
|                                 | <p><b>Remarks/Examples:</b><br/>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.E.7.1</a>.</p>   |

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| <a href="#">SC.912.L.17.11:</a> | Evaluate the costs and benefits of renewable and nonrenewable resources, such as water, energy, fossil fuels, wildlife, and forests.   |
| <a href="#">SC.912.L.17.16:</a> | <p>Discuss the large-scale environmental impacts resulting from human activity, including waste spills, oil spills, runoff, greenhouse gases, ozone depletion, and surface and groundwater pollution.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Integrate <a href="#">HE.912.C.1.3</a>. Evaluate how environment and personal health are interrelated and, <a href="#">HE.912.C.1.5</a>. Analyze strategies for prevention, detection, and treatment of communicable and chronic diseases.</p> </div> |
| <a href="#">SC.912.L.17.20:</a> | <p>Predict the impact of individuals on environmental systems and examine how human lifestyles affect sustainability.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.17.11</a>, <a href="#">SC.912.L.17.13</a>, <a href="#">SC.912.N.1.3</a>.</p> </div>  |
| <a href="#">SC.912.L.18.1:</a>  | <p>Describe the basic molecular structures and primary functions of the four major categories of biological macromolecules.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.18.11</a>.</p> </div>  |
| <a href="#">SC.912.L.18.2:</a>  | Describe the important structural characteristics of monosaccharides, disaccharides, and polysaccharides and explain the functions of carbohydrates in living things.  |
| <a href="#">SC.912.L.18.3:</a>  | Describe the structures of fatty acids, triglycerides, phospholipids, and steroids. Explain the functions of lipids in living organisms. Identify some reactions that fatty acids undergo. Relate the structure and function of cell membranes.  |
| <a href="#">SC.912.L.18.4:</a>  | Describe the structures of proteins and amino acids. Explain the functions of proteins in living organisms. Identify some reactions that amino acids undergo. Relate the structure and function of enzymes.  |
| <a href="#">SC.912.L.18.7:</a>  | Identify the reactants, products, and basic functions of photosynthesis.   |
| <a href="#">SC.912.L.18.8:</a>  | Identify the reactants, products, and basic functions of aerobic and anaerobic cellular respiration.   |
| <a href="#">SC.912.L.18.9:</a>  | Explain the interrelated nature of photosynthesis and cellular respiration.  |

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|   | <p><b>Remarks/Examples:</b><br/>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.18.7</a> <a href="#">SC.912.L.18.8</a> <a href="#">SC.912.L.18.10</a>.</p>  |
| <p><a href="#">SC.912.L.18.10:</a></p>    | <p>Connect the role of adenosine triphosphate (ATP) to energy transfers within a cell.</p>   |
| <p><a href="#">SC.912.L.18.11:</a></p>    | <p>Explain the role of enzymes as catalysts that lower the activation energy of biochemical reactions. Identify factors, such as pH and temperature, and their effect on enzyme activity.</p>  |
| <p><a href="#">SC.912.L.18.12:</a></p>    | <p>Discuss the special properties of water that contribute to Earth's suitability as an environment for life: cohesive behavior, ability to moderate temperature, expansion upon freezing, and versatility as a solvent.</p> <p><b>Remarks/Examples:</b><br/>Annually assessed on Biology EOC.</p>   |
| <p><a href="#">MAFS.912.N-Q.1.1:</a></p>  | <p>Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. ★</p>   |
| <p><a href="#">MAFS.912.N-Q.1.3:</a></p>  | <p>Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. ★</p>   |
| <p><a href="#">MAFS.912.F-IF.2.4:</a></p> | <p>For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. <i>Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</i> ★</p>   |
| <p><a href="#">MAFS.912.F-IF.3.7:</a></p> | <p>Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★</p> <ol style="list-style-type: none"> <li>Graph linear and quadratic functions and show intercepts, maxima, and minima.</li> <li>Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.</li> <li>Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.</li> <li>Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available,</li> </ol> |

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|   | <p>and showing end behavior.</p> <p>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.</p>   |
| <p><a href="#">MAFS.912.G-MG.1.2:</a></p> | <p>Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). ★</p>   |
| <p><a href="#">MAFS.912.S-ID.1.1:</a></p> | <p>Represent data with plots on the real number line (dot plots, histograms, and box plots). ★</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.</p> </div>  |
| <p><a href="#">MAFS.912.S-ID.1.2:</a></p> | <p>Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. ★</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.</p> </div> |
| <p><a href="#">MAFS.912.S-ID.1.3:</a></p> | <p>Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). ★</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.</p> </div>                                     |
| <p><a href="#">MAFS.912.S-ID.1.4:</a></p> | <p>Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. ★</p>  |

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| <a href="#">MAFS.912.S-ID.2.5:</a> | Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. ★   |
| <a href="#">MAFS.912.S-IC.2.6:</a> | Evaluate reports based on data. ★   |
| <a href="#">LAFS.910.SL.1.1:</a>   | <p>Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.</p> <ol style="list-style-type: none"> <li>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.</li> <li>b. Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed.</li> <li>c. Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.</li> <li>d. Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.</li> </ol> |
| <a href="#">LAFS.910.SL.1.2:</a>   | Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.  |
| <a href="#">LAFS.910.SL.1.3:</a>   | Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.   |
| <a href="#">LAFS.910.SL.2.4:</a>   | Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.   |
| <a href="#">LAFS.910.SL.2.5:</a>   | Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.   |

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| <a href="#">LAFS.910.RST.1.1:</a>  | Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.  |
| <a href="#">LAFS.910.RST.1.2:</a>  | Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.  |
| <a href="#">LAFS.910.RST.1.3:</a>  | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.   |
| <a href="#">LAFS.910.RST.2.4:</a>  | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.   |
| <a href="#">LAFS.910.RST.2.5:</a>  | Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).   |
| <a href="#">LAFS.910.RST.2.6:</a>  | Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.   |
| <a href="#">LAFS.910.RST.3.7:</a>  | Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.  |
| <a href="#">LAFS.910.RST.3.8:</a>  | Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.   |
| <a href="#">LAFS.910.RST.3.9:</a>  | Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.  |
| <a href="#">LAFS.910.RST.4.10:</a> | By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.   |
| <a href="#">LAFS.910.WHST.1.1:</a> | <p>Write arguments focused on <i>discipline-specific content</i>.</p> <ol style="list-style-type: none"> <li>a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.</li> <li>b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience's knowledge level</li> </ol> |

and concerns.

- c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.
- d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
- e. Provide a concluding statement or section that follows from or supports the argument presented.

Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

- a. Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.
- b. Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.
- c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts.
- d. Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.
- e. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
- f. Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).

[LAFS.910.WHST.1.2:](#)

Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

[LAFS.910.WHST.2.4:](#)

Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and

[LAFS.910.WHST.2.5:](#)

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|                                     | audience.   |
| <a href="#">LAFS.910.WHST.2.6:</a>  | Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.  |
| <a href="#">LAFS.910.WHST.3.7:</a>  | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.  |
| <a href="#">LAFS.910.WHST.3.8:</a>  | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.                     |
| <a href="#">LAFS.910.WHST.3.9:</a>  | Draw evidence from informational texts to support analysis, reflection, and research.   |
| <a href="#">LAFS.910.WHST.4.10:</a> | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.  |
| <a href="#">HE.912.C.1.3:</a>       | Evaluate how environment and personal health are interrelated.<br><div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>Remarks/Examples:</b><br/> Food options within a community; prenatal-care services; availability of recreational facilities; air quality; weather-safety awareness; and weather, air, and water conditions.</p> </div> |
| <a href="#">HE.912.C.1.5:</a>       | Analyze strategies for prevention, detection, and treatment of communicable and chronic diseases.<br><div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>Remarks/Examples:</b><br/> Health prevention, detection, and treatment of: breast and testicular cancer, suicide, obesity, and industrial-related chronic disease.</p> </div>       |
| <a href="#">HE.912.C.1.7:</a>       | Analyze how heredity and family history can impact personal health.<br><div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>Remarks/Examples:</b><br/> Drug use, family obesity, heart disease, mental health, and non-communicable illness or disease.</p> </div>  |
| <a href="#">HE.912.C.1.8:</a>       | Assess the degree of susceptibility to injury, illness, or death if engaging in unhealthy/risky behaviors.  |



**Remarks/Examples:**

Risks associated with alcohol abuse, including poison, date rape, and death; cancer and chronic lung disease related to tobacco use; overdose from drug use; child abuse or neglect; and dating violence.

[ELD.K12.ELL.1.1:](#)

English language learners communicate for social and instructional purposes within the school setting.

[ELD.K12.ELL.XX.1:](#)

English language learners communicate information, ideas and concepts necessary for academic success in the content area of Science.

## **Biology 2 Honors (#2000330)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 2000330

**Abbreviated Title:** BIO 2 HON

**Number of Credits:** One credit (1)

**Course Length:** Year (Y)

**Honors?** Yes

**Course Type:** Core

**Course Level:** 3

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 9,10,11,12

### **GENERAL NOTES**

Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National Science Teachers Association (NSTA) recommends that at the high school level, all students should be in the science lab or field, collecting data every week. School laboratory investigations (labs) are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the high school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (National Research Council, 2006, p.77; NSTA, 2007).

### **Special Notes:**

#### **Instructional Practices**

Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:

1. Ensuring wide reading from complex text that varies in length.
2. Making close reading and rereading of texts central to lessons.
3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.
4. Emphasizing students supporting answers based upon evidence from the text.
5. Providing extensive research and writing opportunities (claims and evidence).

### **English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Science. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/SC.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

### **COURSE STANDARDS**

#### **Integrate Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

#### **Science and Engineering Practices (NRC Framework for K-12 Science Education, 2010)**

- Asking questions (for science) and defining problems (for engineering).
- Developing and using models.
- Planning and carrying out investigations.
- Analyzing and interpreting data.
- Using mathematics, information and computer technology, and computational thinking.
- Constructing explanations (for science) and designing solutions (for engineering).
- Engaging in argument from evidence.
- Obtaining, evaluating, and communicating information.

| Name | Description |
|------|-------------|
|------|-------------|

Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:

1. **Pose questions about the natural world,** (Articulate the purpose of the investigation and identify the relevant scientific concepts).
2. **Conduct systematic observations,** (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).
3. **Examine books and other sources of information to see what is already known,**
4. **Review what is known in light of empirical evidence,** (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).
5. **Plan investigations,** (Design and evaluate a scientific investigation).
6. **Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),** (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).
7. **Pose answers, explanations, or descriptions of events,**
8. **Generate explanations that explicate or describe natural phenomena (inferences),**
9. **Use appropriate evidence and reasoning to justify these explanations to others,**
10. **Communicate results of scientific investigations, and**
11. **Evaluate the merits of the explanations produced by others.**

[SC.912.N.1.1:](#)

**Remarks/Examples:**

Florida Standards Connections for 6-12 Literacy in Science

For Students in Grades 9-10

LAFS.910.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.

LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.

For Students in Grades 11-12

LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks analyze the specific results based on explanations in the text.

LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

LAFS.1112.WHST.3.9 Draw evidence from informational

texts to support analysis, reflection, and research.

Florida Standards Connections for Mathematical Practices

MAFS.K12.MP.1: Make sense of problems and persevere in solving them.

MAFS.K12.MP.2: Reason abstractly and quantitatively.

MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]

MAFS.K12.MP.4: Model with mathematics.

MAFS.K12.MP.5: Use appropriate tools strategically.

MAFS.K12.MP.6: Attend to precision.

MAFS.K12.MP.7: Look for and make use of structure.

MAFS.K12.MP.8: Look for and express regularity in repeated reasoning.

[SC.912.N.1.4:](#)

Identify sources of information and assess their reliability according to the strict standards of scientific investigation.

**Remarks/Examples:**

Read, interpret, and examine the credibility and validity of scientific claims in different sources of information, such as scientific articles, advertisements, or media stories.

Strict standards of science include controlled variables, sufficient sample size, replication of results, empirical and measurable evidence, and the concept of falsification.

Florida Standards Connections: [LAFS.910.RST.1.1](#) / [LAFS.1112.RST.1.1](#).

[SC.912.N.1.5:](#)

Describe and provide examples of how similar investigations conducted in many parts of the world result in the same outcome.

**Remarks/Examples:**

Recognize that contributions to science can be made and have been made by people from all over the world.

[SC.912.N.1.7:](#)

Recognize the role of creativity in constructing scientific questions, methods and explanations.

**Remarks/Examples:**

Work through difficult problems using creativity, and critical and analytical thinking in problem solving (e.g.

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|--------------------------------------|--|
|                                      | <p>convergent versus divergent thinking and creativity in problem solving).</p> <p>Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them and MAFS.K12.MP.2: Reason abstractly and quantitatively.</p>   |
| <p><a href="#">SC.912.N.2.1:</a></p> | <p>Identify what is science, what clearly is not science, and what superficially resembles science (but fails to meet the criteria for science).</p> <p><b>Remarks/Examples:</b><br/>Science is the systematic and organized inquiry that is derived from observations and experimentation that can be verified or tested by further investigation to explain natural phenomena (e.g. Science is testable, pseudo-science is not science seeks falsifications, pseudo-science seeks confirmations.)</p>  |
| <p><a href="#">SC.912.N.2.2:</a></p> | <p>Identify which questions can be answered through science and which questions are outside the boundaries of scientific investigation, such as questions addressed by other ways of knowing, such as art, philosophy, and religion.</p> <p><b>Remarks/Examples:</b><br/>Identify scientific questions that can be disproved by experimentation/testing. Recognize that pseudoscience is a claim, belief, or practice which is presented as scientific, but does not adhere to strict standards of science (e.g. controlled variables, sample size, replicability, empirical and measurable evidence, and the concept of falsification).</p> <p>Florida Standards Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others.</p> |
| <p><a href="#">SC.912.N.2.4:</a></p> | <p>Explain that scientific knowledge is both durable and robust and open to change. Scientific knowledge can change because it is often examined and re-examined by new investigations and scientific argumentation. Because of these frequent examinations, scientific knowledge becomes stronger, leading to its durability.</p> <p><b>Remarks/Examples:</b><br/>Recognize that ideas with the most durable explanatory power become established theories, but scientific</p>  |

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|                                      | <p>explanations are continually subjected to change in the face of new evidence.</p> <p>Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them<br/>MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others.</p>   |
| <p><a href="#">SC.912.N.2.5:</a></p> | <p>Describe instances in which scientists' varied backgrounds, talents, interests, and goals influence the inferences and thus the explanations that they make about observations of natural phenomena and describe that competing interpretations (explanations) of scientists are a strength of science as they are a source of new, testable ideas that have the potential to add new evidence to support one or another of the explanations.</p> <p><b>Remarks/Examples:</b><br/>Recognize that scientific questions, observations, and conclusions may be influenced by the existing state of scientific knowledge, the social and cultural context of the researcher, and the observer's experiences and expectations. Identify possible bias in qualitative and quantitative data analysis.</p> |
| <p><a href="#">SC.912.N.3.1:</a></p> | <p>Explain that a scientific theory is the culmination of many scientific investigations drawing together all the current evidence concerning a substantial range of phenomena; thus, a scientific theory represents the most powerful explanation scientists have to offer.</p> <p><b>Remarks/Examples:</b><br/>Explain that a scientific theory is a well-tested hypothesis supported by a preponderance of empirical evidence.</p> <p>Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them and, MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others.</p>   |
| <p><a href="#">SC.912.N.3.2:</a></p> | <p>Describe the role consensus plays in the historical development of a theory in any one of the disciplines of science.</p> <p><b>Remarks/Examples:</b><br/>Recognize that scientific argument, disagreement, discourse, and discussion create a broader and more accurate understanding of natural processes and events.</p>   |



Florida Standards Connections: MAFS.K12.MP.3:  
Construct viable arguments and critique the reasoning of others.

Weigh the merits of alternative strategies for solving a specific societal problem by comparing a number of different costs and benefits, such as human, economic, and environmental.

[SC.912.N.4.2:](#)

**Remarks/Examples:**

Identify examples of technologies, objects, and processes that have been modified to advance society, and explain why and how they were modified. Discuss ethics in scientific research to advance society (e.g. global climate change, historical development of medicine and medical practices).

Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively.

Describe oxidation-reduction reactions in living and non-living systems.

[SC.912.P.8.10:](#)

**Remarks/Examples:**

Identify the substance(s) losing and gaining electrons in oxidation-reduction reactions. Discuss voltaic cells, various types of batteries, electrolysis of water, smelting and purification of metals, electrolysis of brine versus molten NaCl, neutralization reactions, electrolytic cells, and living systems (photosynthesis and cellular respiration).

Differentiate among the various forms of energy and recognize that they can be transformed from one form to others.

[SC.912.P.10.1:](#)

**Remarks/Examples:**

Differentiate between kinetic and potential energy.  
Recognize that energy cannot be created or destroyed, only transformed. Identify examples of transformation of energy: Heat to light in incandescent electric light bulbs  
Light to heat in laser drills  
Electrical to sound in radios  
Sound to electrical in microphones  
Electrical to chemical in battery rechargers  
Chemical to electrical in dry cells  
Mechanical to electrical in generators [power plants]  
Nuclear to heat in nuclear reactors  
Gravitational potential energy of a falling object is converted to kinetic energy

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|                                 | then to heat and sound energy when the object hits the ground.   |
| <a href="#">SC.912.L.14.6:</a>  | Explain the significance of genetic factors, environmental factors, and pathogenic agents to health from the perspectives of both individual and public health.  |
| <a href="#">SC.912.L.14.8:</a>  | Explain alternation of generations in plants.  |
| <a href="#">SC.912.L.14.9:</a>  | Relate the major structure of fungi to their functions.  |
| <a href="#">SC.912.L.14.50:</a> | Describe the structure of vertebrate sensory organs. Relate structure to function in vertebrate sensory systems.   |
| <a href="#">SC.912.L.14.53:</a> | Discuss basic classification and characteristics of plants. Identify bryophytes, pteridophytes, gymnosperms, and angiosperms.  |
|                                 | Explain how the scientific theory of evolution is supported by the fossil record, comparative anatomy, comparative embryology, biogeography, molecular biology, and observed evolutionary change.  |
| <a href="#">SC.912.L.15.1:</a>  | <p><b>Remarks/Examples:</b></p> <p>Annually Assessed on Biology EOC. Also assesses <a href="#">SC.912.L.15.10</a> <a href="#">SC.912.N.1.3</a> <a href="#">SC.912.N.1.4</a> <a href="#">SC.912.N.1.6</a> <a href="#">SC.912.N.2.1</a> <a href="#">SC.912.N.3.1</a> and <a href="#">SC.912.N.3.4</a>.</p> |
| <a href="#">SC.912.L.15.4:</a>  | Describe how and why organisms are hierarchically classified and based on evolutionary relationships.  |
| <a href="#">SC.912.L.15.5:</a>  | Explain the reasons for changes in how organisms are classified.   |
| <a href="#">SC.912.L.15.7:</a>  | Discuss distinguishing characteristics of vertebrate and representative invertebrate phyla, and chordate classes using typical examples.   |
|                                 | Describe the scientific explanations of the origin of life on Earth.   |
| <a href="#">SC.912.L.15.8:</a>  | <p><b>Remarks/Examples:</b></p> <p>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.N.1.3</a>, <a href="#">SC.912.N.1.4</a>, and <a href="#">SC.912.N.2.1</a>.</p>   |
| <a href="#">SC.912.L.15.9:</a>  | Explain the role of reproductive isolation in the process of speciation.   |
| <a href="#">SC.912.L.15.11:</a> | Discuss specific fossil hominids and what they show about human evolution.   |
| <a href="#">SC.912.L.16.15:</a> | Compare and contrast binary fission and mitotic cell division.   |
| <a href="#">SC.912.L.16.6:</a>  | Discuss the mechanisms for regulation of gene expression in  |

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|                                 | prokaryotes and eukaryotes at transcription and translation level.   |
| <a href="#">SC.912.L.16.7:</a>  | Describe how viruses and bacteria transfer genetic material between cells and the role of this process in biotechnology.   |
| <a href="#">SC.912.L.16.11:</a> | Discuss the technologies associated with forensic medicine and DNA identification, including restriction fragment length polymorphism (RFLP) analysis.   |
| <a href="#">SC.912.L.16.12:</a> | Describe how basic DNA technology (restriction digestion by endonucleases, gel electrophoresis, polymerase chain reaction, ligation, and transformation) is used to construct recombinant DNA molecules (DNA cloning). |
| <a href="#">SC.912.L.17.14:</a> | Assess the need for adequate waste management strategies.  |
| <a href="#">SC.912.L.17.15:</a> | Discuss the effects of technology on environmental quality.  |
| <a href="#">SC.912.L.17.17:</a> | Assess the effectiveness of innovative methods of protecting the environment.  |
|                                 | Discuss the political, social, and environmental consequences of sustainable use of land.  |
| <a href="#">SC.912.L.17.12:</a> | <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Integrate <a href="#">HE.912.C.1.3</a>. Evaluate how environment and personal health are interrelated.</p> </div>                 |
| <a href="#">SC.912.L.17.18:</a> | Describe how human population size and resource use relate to environmental quality.   |
|                                 | Discuss the characteristics of populations, such as number of individuals, age structure, density, and pattern of distribution.  |
| <a href="#">SC.912.L.17.1:</a>  | <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/>Florida Standards Connections: MAFS.K12.MP.7: Look for and make use of structure.</p> </div>                                      |
| <a href="#">SC.912.L.17.3:</a>  | Discuss how various oceanic and freshwater processes, such as currents, tides, and waves, affect the abundance of aquatic organisms.   |
| <a href="#">SC.912.L.17.6:</a>  | Compare and contrast the relationships among organisms, including predation, parasitism, competition, commensalism, and mutualism.   |
| <a href="#">SC.912.L.17.7:</a>  | Characterize the biotic and abiotic components that define freshwater systems, marine systems and terrestrial systems.   |
| <a href="#">SC.912.L.17.8:</a>  | Recognize the consequences of the losses of biodiversity due to catastrophic events, climate changes, human activity, and the introduction of invasive, non-native species.  |
| <a href="#">SC.912.L.17.9:</a>  | Use a food web to identify and distinguish producers, consumers, and decomposers. Explain the pathway of energy  |

transfer through trophic levels and the reduction of available energy at successive trophic levels.

**Remarks/Examples:**

Annually assessed on Biology EOC. Also assesses [SC.912.E.7.1](#).

[SC.912.L.17.10:](#)

Diagram and explain the biogeochemical cycles of an ecosystem, including water, carbon, and nitrogen cycle.

[SC.912.L.17.11:](#)

Evaluate the costs and benefits of renewable and nonrenewable resources, such as water, energy, fossil fuels, wildlife, and forests.

[SC.912.L.17.13:](#)

Discuss the need for adequate monitoring of environmental parameters when making policy decisions.

[SC.912.L.17.16:](#)

Discuss the large-scale environmental impacts resulting from human activity, including waste spills, oil spills, runoff, greenhouse gases, ozone depletion, and surface and groundwater pollution.

**Remarks/Examples:**

Integrate [HE.912.C.1.3](#). Evaluate how environment and personal health are interrelated and, [HE.912.C.1.5](#). Analyze strategies for prevention, detection, and treatment of communicable and chronic diseases.

[SC.912.L.17.19:](#)

Describe how different natural resources are produced and how their rates of use and renewal limit availability.

Predict the impact of individuals on environmental systems and examine how human lifestyles affect sustainability.

[SC.912.L.17.20:](#)

**Remarks/Examples:**

Annually assessed on Biology EOC. Also assesses [SC.912.L.17.11](#), [SC.912.L.17.13](#), [SC.912.N.1.3](#).

[SC.912.L.18.1:](#)

Describe the basic molecular structures and primary functions of the four major categories of biological macromolecules.

**Remarks/Examples:**

Annually assessed on Biology EOC. Also assesses [SC.912.L.18.11](#).

[SC.912.L.18.5:](#)

Discuss the use of chemiosmotic gradients for ATP production in chloroplasts and mitochondria.

[SC.912.L.18.7:](#)

Identify the reactants, products, and basic functions of photosynthesis.

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|------------------------------------|---|
| <a href="#">SC.912.L.18.8:</a>     | Identify the reactants, products, and basic functions of aerobic and anaerobic cellular respiration.  |
|                                    | Explain the interrelated nature of photosynthesis and cellular respiration.   |
| <a href="#">SC.912.L.18.9:</a>     | <p><b>Remarks/Examples:</b></p> <p>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.18.7</a> <a href="#">SC.912.L.18.8</a> <a href="#">SC.912.L.18.10</a>.</p>  |
| <a href="#">SC.912.L.18.10:</a>    | Connect the role of adenosine triphosphate (ATP) to energy transfers within a cell.   |
| <a href="#">SC.912.L.18.11:</a>    | Explain the role of enzymes as catalysts that lower the activation energy of biochemical reactions. Identify factors, such as pH and temperature, and their effect on enzyme activity.  |
| <a href="#">SC.912.L.18.12:</a>    | Discuss the special properties of water that contribute to Earth's suitability as an environment for life: cohesive behavior, ability to moderate temperature, expansion upon freezing, and versatility as a solvent.   |
|                                    | <p><b>Remarks/Examples:</b></p> <p>Annually assessed on Biology EOC.</p>  |
| <a href="#">MAFS.912.N-Q.1.1:</a>  | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. ★   |
| <a href="#">MAFS.912.N-Q.1.3:</a>  | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. ★   |
| <a href="#">MAFS.912.F-IF.2.4:</a> | For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. <i>Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</i> ★ |
|                                    | Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★   |
| <a href="#">MAFS.912.F-IF.3.7:</a> | <ol style="list-style-type: none"> <li>Graph linear and quadratic functions and show intercepts, maxima, and minima.</li> <li>Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.</li> </ol>  |

- c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.
- d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.
- e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.

[MAFS.912.G-MG.1.2:](#)

Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). ★

[MAFS.912.S-ID.1.1:](#)

Represent data with plots on the real number line (dot plots, histograms, and box plots). ★

**Remarks/Examples:**

In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.

[MAFS.912.S-ID.1.2:](#)

Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. ★

**Remarks/Examples:**

In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.

[MAFS.912.S-ID.1.3:](#)

Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). ★

**Remarks/Examples:**

In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.

|   |  |
|---|--|
| <p><a href="#">MAFS.912.S-ID.1.4:</a></p> | <p>Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. ★</p>  |
| <p><a href="#">MAFS.912.S-ID.2.5:</a></p> | <p>Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. ★</p>   |
| <p><a href="#">MAFS.912.S-ID.2.6:</a></p> | <p>Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. ★</p> <ol style="list-style-type: none"> <li>a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. <i>Use given functions or choose a function suggested by the context. Emphasize linear, and exponential models.</i></li> <li>b. Informally assess the fit of a function by plotting and analyzing residuals.</li> <li>c. Fit a linear function for a scatter plot that suggests a linear association.</li> </ol> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>Remarks/Examples:</b><br/> Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals.</p> </div> |
| <p><a href="#">MAFS.912.S-IC.2.6:</a></p> | <p>Evaluate reports based on data. ★</p>   |
| <p><a href="#">LAFS.1112.SL.1.1:</a></p>  | <p>Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.</p> <ol style="list-style-type: none"> <li>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.</li> <li>b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.</li> </ol>   |

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|                                    | <ul style="list-style-type: none"> <li>c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.</li> <li>d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task.</li> </ul> |
| <a href="#">LAFS.1112.SL.1.2:</a>  | Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.   |
| <a href="#">LAFS.1112.SL.1.3:</a>  | Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used.   |
| <a href="#">LAFS.1112.SL.2.4:</a>  | Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.   |
| <a href="#">LAFS.1112.SL.2.5:</a>  | Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.   |
| <a href="#">LAFS.1112.RST.1.1:</a> | Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.  |
| <a href="#">LAFS.1112.RST.1.2:</a> | Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.   |
| <a href="#">LAFS.1112.RST.1.3:</a> | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.   |
| <a href="#">LAFS.1112.RST.2.4:</a> | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.  |



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| <a href="#">LAFS.1112.RST.2.5:</a>  | Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.   |
| <a href="#">LAFS.1112.RST.2.6:</a>  | Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.   |
| <a href="#">LAFS.1112.RST.3.7:</a>  | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.   |
| <a href="#">LAFS.1112.RST.3.8:</a>  | Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.   |
| <a href="#">LAFS.1112.RST.3.9:</a>  | Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.   |
| <a href="#">LAFS.1112.RST.4.10:</a> | By the end of grade 12, read and comprehend science/technical texts in the grades 11–12 text complexity band independently and proficiently.  |
| <a href="#">LAFS.1112.WHST.1.1:</a> | <p>Write arguments focused on <i>discipline-specific content</i>.</p> <ol style="list-style-type: none"> <li>a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.</li> <li>b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience’s knowledge level, concerns, values, and possible biases.</li> <li>c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.</li> <li>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.</li> <li>e. Provide a concluding statement or section that follows</li> </ol> |

from or supports the argument presented.

Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

[LAFS.1112.WHST.1.2:](#)

- a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.
- b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.
- c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.
- d. Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.
- e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic).

[LAFS.1112.WHST.2.4:](#)

Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

[LAFS.1112.WHST.2.5:](#)

Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

[LAFS.1112.WHST.2.6:](#)

Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.

[LAFS.1112.WHST.3.7:](#)

Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating

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|                                      | understanding of the subject under investigation.   |
| <a href="#">LAFS.1112.WHST.3.8:</a>  | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. |
| <a href="#">LAFS.1112.WHST.3.9:</a>  | Draw evidence from informational texts to support analysis, reflection, and research.   |
| <a href="#">LAFS.1112.WHST.4.10:</a> | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.  |
| <a href="#">HE.912.C.1.3:</a>        | Evaluate how environment and personal health are interrelated.<br><br><b>Remarks/Examples:</b><br>Food options within a community; prenatal-care services; availability of recreational facilities; air quality; weather-safety awareness; and weather, air, and water conditions.  |
| <a href="#">HE.912.C.1.5:</a>        | Analyze strategies for prevention, detection, and treatment of communicable and chronic diseases.<br><br><b>Remarks/Examples:</b><br>Health prevention, detection, and treatment of: breast and testicular cancer, suicide, obesity, and industrial-related chronic disease.  |
| <a href="#">HE.912.C.1.7:</a>        | Analyze how heredity and family history can impact personal health.<br><br><b>Remarks/Examples:</b><br>Drug use, family obesity, heart disease, mental health, and non-communicable illness or disease.   |
| <a href="#">ELD.K12.ELL.1.1:</a>     | English language learners communicate for social and instructional purposes within the school setting.  |
| <a href="#">ELD.K12.ELL.XX.1:</a>    | English language learners communicate information, ideas and concepts necessary for academic success in the content area of Science.  |

## **Biology Technology (#2000430)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 2000430

**Abbreviated Title:** BIO TECH

**Number of Credits:** One credit (1)

**Course Length:** Year (Y)

**Course Type:** Core

**Course Level:** 2

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 9,10,11,12

### **GENERAL NOTES**

#### **English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Science. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/SC.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

### **COURSE STANDARDS**

#### **Integrate Standards for Mathematical Practice (MP) as applicable.**

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.

- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

| Name                                 | Description  |
|--------------------------------------|--|
| <p><a href="#">SC.912.N.1.1:</a></p> | <p>Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:</p> <ol style="list-style-type: none"> <li>1. <b>Pose questions about the natural world</b>, (Articulate the purpose of the investigation and identify the relevant scientific concepts).</li> <li>2. <b>Conduct systematic observations</b>, (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).</li> <li>3. <b>Examine books and other sources of information to see what is already known</b>,</li> <li>4. <b>Review what is known in light of empirical evidence</b>, (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).</li> <li>5. <b>Plan investigations</b>, (Design and evaluate a scientific investigation).</li> <li>6. <b>Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs)</b>, (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).</li> <li>7. <b>Pose answers, explanations, or descriptions of events</b>,</li> <li>8. <b>Generate explanations that explicate or describe natural phenomena (inferences)</b>,</li> <li>9. <b>Use appropriate evidence and reasoning to justify these explanations to others</b>,</li> <li>10. <b>Communicate results of scientific investigations</b>, and</li> <li>11. <b>Evaluate the merits of the explanations produced by others</b>.</li> </ol> |
|                                      | <p><b>Remarks/Examples:</b></p> <p>Florida Standards Connections for 6-12 Literacy in</p>  |

## Science

### For Students in Grades 9-10

LAFS.910.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.

LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.

### For Students in Grades 11-12

LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks analyze the specific results based on explanations in the text.

LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific

procedures/ experiments, or technical processes.

LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.

Florida Standards Connections for Mathematical Practices

MAFS.K12.MP.1: Make sense of problems and persevere in solving them.

MAFS.K12.MP.2: Reason abstractly and quantitatively.

MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]

MAFS.K12.MP.4: Model with mathematics.

MAFS.K12.MP.5: Use appropriate tools strategically.

MAFS.K12.MP.6: Attend to precision.

MAFS.K12.MP.7: Look for and make use of structure.

MAFS.K12.MP.8: Look for and express regularity in repeated reasoning.

[SC.912.N.1.3:](#)

Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented.

**Remarks/Examples:**

Assess the reliability of data and identify reasons for inconsistent results, such as sources of error or uncontrolled conditions.

Florida Standards Connections: MAFS.K12.MP.2: Reason abstractly and quantitatively MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others

[SC.912.N.1.4:](#)

Identify sources of information and assess their reliability according to the strict standards of scientific investigation.

**Remarks/Examples:**

Read, interpret, and examine the credibility and validity of scientific claims in different sources of information, such as scientific articles, advertisements, or media stories. Strict standards of science include controlled variables, sufficient sample size, replication of results, empirical and measurable evidence, and the concept of falsification.

Florida Standards Connections: [LAFS.910.RST.1.1](#) /

[LAFS.1112.RST.1.1.](#)

Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.

[SC.912.N.1.6:](#)

**Remarks/Examples:**

Collect data/evidence and use tables/graphs to draw conclusions and make inferences based on patterns or trends in the data.

Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them.

Identify what is science, what clearly is not science, and what superficially resembles science (but fails to meet the criteria for science).

[SC.912.N.2.1:](#)

**Remarks/Examples:**

Science is the systematic and organized inquiry that is derived from observations and experimentation that can be verified or tested by further investigation to explain natural phenomena (e.g. Science is testable, pseudo-science is not science seeks falsifications, pseudo-science seeks confirmations.)

Identify which questions can be answered through science and which questions are outside the boundaries of scientific investigation, such as questions addressed by other ways of knowing, such as art, philosophy, and religion.

[SC.912.N.2.2:](#)

**Remarks/Examples:**

Identify scientific questions that can be disproved by experimentation/testing. Recognize that pseudoscience is a claim, belief, or practice which is presented as scientific, but does not adhere to strict standards of science (e.g. controlled variables, sample size, replicability, empirical and measurable evidence, and the concept of falsification).

Florida Standards Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others.

[SC.912.N.3.1:](#)

Explain that a scientific theory is the culmination of many scientific investigations drawing together all the current evidence concerning a substantial range of phenomena; thus, a scientific



theory represents the most powerful explanation scientists have to offer.

**Remarks/Examples:**

Explain that a scientific theory is a well-tested hypothesis supported by a preponderance of empirical evidence.

Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them and, MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others.

[SC.912.N.3.4:](#)

Recognize that theories do not become laws, nor do laws become theories; theories are well supported explanations and laws are well supported descriptions.

**Remarks/Examples:**

Recognize that theories do not become laws, theories explain laws. Recognize that not all scientific laws have accompanying explanatory theories.

[SC.912.N.4.1:](#)

Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making.

**Remarks/Examples:**

Recognize that no single universal step-by-step scientific method captures the complexity of doing science. A number of shared values and perspectives characterize a scientific approach.

MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively.

[SC.912.N.4.2:](#)

Weigh the merits of alternative strategies for solving a specific societal problem by comparing a number of different costs and benefits, such as human, economic, and environmental.

**Remarks/Examples:**

Identify examples of technologies, objects, and processes that have been modified to advance society, and explain why and how they were modified. Discuss ethics in scientific research to advance society (e.g. global climate change, historical development of medicine and medical practices).

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|  | <p>Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively.</p>  |
| <p><a href="#">SC.912.P.12.12:</a></p> | <p>Explain how various factors, such as concentration, temperature, and presence of a catalyst affect the rate of a chemical reaction.</p> <p><b>Remarks/Examples:</b></p> <p>Various factors could include: temperature, pressure, solvent and/or solute concentration, sterics, surface area, and catalysts. The rate of reaction is determined by the activation energy, and the pathway of the reaction can be shorter in the presence of enzymes or catalysts. Examples may include: decomposition of hydrogen peroxide using manganese (IV) oxide nitration of benzene using concentrated sulfuric acid hydrogenation of a C=C double bond using nickel.</p> |
| <p><a href="#">SC.912.L.14.4:</a></p>  | <p>Compare and contrast structure and function of various types of microscopes.</p>  |
| <p><a href="#">SC.912.L.14.2:</a></p>  | <p>Relate structure to function for the components of plant and animal cells. Explain the role of cell membranes as a highly selective barrier (passive and active transport).</p>   |
| <p><a href="#">SC.912.L.14.3:</a></p>  | <p>Compare and contrast the general structures of plant and animal cells. Compare and contrast the general structures of prokaryotic and eukaryotic cells.</p> <p><b>Remarks/Examples:</b></p> <p>Annually Assessed on Biology EOC. Also assesses <a href="#">SC.912.L.14.2</a>.</p>   |
| <p><a href="#">SC.912.L.14.6:</a></p>  | <p>Explain the significance of genetic factors, environmental factors, and pathogenic agents to health from the perspectives of both individual and public health.</p>   |
| <p><a href="#">SC.912.L.14.7:</a></p>  | <p>Relate the structure of each of the major plant organs and tissues to physiological processes.</p> <p><b>Remarks/Examples:</b></p> <p>Annually Assessed on Biology EOC.</p>   |
| <p><a href="#">SC.912.L.14.26:</a></p> | <p>Identify the major parts of the brain on diagrams or models.</p> <p><b>Remarks/Examples:</b></p> <p>Annually Assessed on Biology EOC.</p>   |

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|                                 | Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.   |
| <a href="#">SC.912.L.14.36:</a> | Describe the factors affecting blood flow through the cardiovascular system.  |
| <a href="#">SC.912.L.14.52:</a> | Explain the basic functions of the human immune system, including specific and nonspecific immune response, vaccines, and antibiotics.<br><b>Remarks/Examples:</b><br>Annually Assessed on Biology EOC. Also assesses <a href="#">SC.912.L.14.6</a> <a href="#">HE.912.C.1.7</a> and <a href="#">HE.912.C.1.5</a> .   |
| <a href="#">SC.912.L.15.1:</a>  | Explain how the scientific theory of evolution is supported by the fossil record, comparative anatomy, comparative embryology, biogeography, molecular biology, and observed evolutionary change.<br><b>Remarks/Examples:</b><br>Annually Assessed on Biology EOC. Also assesses <a href="#">SC.912.L.15.10</a> <a href="#">SC.912.N.1.3</a> <a href="#">SC.912.N.1.4</a> <a href="#">SC.912.N.1.6</a> <a href="#">SC.912.N.2.1</a> <a href="#">SC.912.N.3.1</a> and <a href="#">SC.912.N.3.4</a> . |
| <a href="#">SC.912.L.15.4:</a>  | Describe how and why organisms are hierarchically classified and based on evolutionary relationships.   |
| <a href="#">SC.912.L.15.5:</a>  | Explain the reasons for changes in how organisms are classified.  |
| <a href="#">SC.912.L.15.6:</a>  | Discuss distinguishing characteristics of the domains and kingdoms of living organisms.<br><b>Remarks/Examples:</b><br>Annually Assessed on Biology EOC. Also assesses <a href="#">SC.912.L.15.4</a> <a href="#">SC.912.L.15.5</a> <a href="#">SC.912.N.1.3</a> and <a href="#">SC.912.N.1.6</a> .  |
| <a href="#">SC.912.L.15.8:</a>  | Describe the scientific explanations of the origin of life on Earth.<br><b>Remarks/Examples:</b><br>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.N.1.3</a> , <a href="#">SC.912.N.1.4</a> , and <a href="#">SC.912.N.2.1</a> .  |
| <a href="#">SC.912.L.15.10:</a> | Identify basic trends in hominid evolution from early ancestors six million years ago to modern humans, including brain size, jaw size, language, and manufacture of tools.   |
| <a href="#">SC.912.L.15.13:</a> | Describe the conditions required for natural selection, including: overproduction of offspring, inherited variation, and the struggle   |

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|                                 | to survive, which result in differential reproductive success.  |
|                                 | <p><b>Remarks/Examples:</b></p> <p>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.15.14</a>, <a href="#">SC.912.L.15.15</a>, and <a href="#">SC.912.N.1.3</a>.</p>  |
| <a href="#">SC.912.L.15.14:</a> | Discuss mechanisms of evolutionary change other than natural selection such as genetic drift and gene flow.   |
| <a href="#">SC.912.L.15.15:</a> | Describe how mutation and genetic recombination increase genetic variation.   |
|                                 | Use Mendel's laws of segregation and independent assortment to analyze patterns of inheritance.   |
| <a href="#">SC.912.L.16.1:</a>  | <p><b>Remarks/Examples:</b></p> <p>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.16.2</a>.</p>   |
| <a href="#">SC.912.L.16.2:</a>  | Discuss observed inheritance patterns caused by various modes of inheritance, including dominant, recessive, codominant, sex-linked, polygenic, and multiple alleles.   |
| <a href="#">SC.912.L.16.9:</a>  | Explain how and why the genetic code is universal and is common to almost all organisms.  |
|                                 | Describe the basic process of DNA replication and how it relates to the transmission and conservation of the genetic information.   |
| <a href="#">SC.912.L.16.3:</a>  | <p><b>Remarks/Examples:</b></p> <p>Integrate <a href="#">HE.912.C.1.7</a>. Analyze how heredity and family history can impact personal health. Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.16.4</a> <a href="#">SC.912.L.16.5</a> <a href="#">SC.912.L.16.9</a>.</p> |
| <a href="#">SC.912.L.16.4:</a>  | Explain how mutations in the DNA sequence may or may not result in phenotypic change. Explain how mutations in gametes may result in phenotypic changes in offspring.   |
| <a href="#">SC.912.L.16.5:</a>  | Explain the basic processes of transcription and translation, and how they result in the expression of genes.   |
| <a href="#">SC.912.L.16.6:</a>  | Discuss the mechanisms for regulation of gene expression in prokaryotes and eukaryotes at transcription and translation level.  |
| <a href="#">SC.912.L.16.7:</a>  | Describe how viruses and bacteria transfer genetic material between cells and the role of this process in biotechnology.  |
| <a href="#">SC.912.L.16.8:</a>  | Explain the relationship between mutation, cell cycle, and uncontrolled cell growth potentially resulting in cancer.  |

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|                                 | <p><b>Remarks/Examples:</b></p> <p>Integrate <a href="#">HE.912.C.1.7</a>. Analyze how heredity and family history can impact personal health.</p>   |
| <a href="#">SC.912.L.16.10:</a> | <p>Evaluate the impact of biotechnology on the individual, society and the environment, including medical and ethical issues.</p> <p><b>Remarks/Examples:</b></p> <p>Annually assessed on Biology EOC.</p>   |
| <a href="#">SC.912.L.16.11:</a> | <p>Discuss the technologies associated with forensic medicine and DNA identification, including restriction fragment length polymorphism (RFLP) analysis.</p>  |
| <a href="#">SC.912.L.16.12:</a> | <p>Describe how basic DNA technology (restriction digestion by endonucleases, gel electrophoresis, polymerase chain reaction, ligation, and transformation) is used to construct recombinant DNA molecules (DNA cloning).</p>  |
| <a href="#">SC.912.L.16.13:</a> | <p>Describe the basic anatomy and physiology of the human reproductive system. Describe the process of human development from fertilization to birth and major changes that occur in each trimester of pregnancy.</p> <p><b>Remarks/Examples:</b></p> <p>Annually assessed on Biology EOC.</p>   |
| <a href="#">SC.912.L.16.14:</a> | <p>Describe the cell cycle, including the process of mitosis. Explain the role of mitosis in the formation of new cells and its importance in maintaining chromosome number during asexual reproduction.</p>   |
| <a href="#">SC.912.L.16.16:</a> | <p>Describe the process of meiosis, including independent assortment and crossing over. Explain how reduction division results in the formation of haploid gametes or spores.</p>  |
| <a href="#">SC.912.L.16.17:</a> | <p>Compare and contrast mitosis and meiosis and relate to the processes of sexual and asexual reproduction and their consequences for genetic variation.</p> <p><b>Remarks/Examples:</b></p> <p>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.16.8</a> <a href="#">SC.912.L.16.14</a> <a href="#">SC.912.L.16.16</a>.</p> |
| <a href="#">SC.912.L.17.2:</a>  | <p>Explain the general distribution of life in aquatic systems as a function of chemistry, geography, light, depth, salinity, and temperature.</p>   |
| <a href="#">SC.912.L.17.4:</a>  | <p>Describe changes in ecosystems resulting from seasonal</p>  |

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|                                 | variations, climate change and succession.  |
| <a href="#">SC.912.L.17.5:</a>  | Analyze how population size is determined by births, deaths, immigration, emigration, and limiting factors (biotic and abiotic) that determine carrying capacity.<br><br><b>Remarks/Examples:</b><br>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.17.2</a> <a href="#">SC.912.L.17.4</a> <a href="#">SC.912.L.17.8</a> <a href="#">SC.912.N.1.4</a> . |
| <a href="#">SC.912.L.17.8:</a>  | Recognize the consequences of the losses of biodiversity due to catastrophic events, climate changes, human activity, and the introduction of invasive, non-native species.   |
| <a href="#">SC.912.L.17.9:</a>  | Use a food web to identify and distinguish producers, consumers, and decomposers. Explain the pathway of energy transfer through trophic levels and the reduction of available energy at successive trophic levels.<br><br><b>Remarks/Examples:</b><br>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.E.7.1</a> .   |
| <a href="#">SC.912.L.17.11:</a> | Evaluate the costs and benefits of renewable and nonrenewable resources, such as water, energy, fossil fuels, wildlife, and forests.  |
| <a href="#">SC.912.L.17.13:</a> | Discuss the need for adequate monitoring of environmental parameters when making policy decisions.  |
| <a href="#">SC.912.L.17.20:</a> | Predict the impact of individuals on environmental systems and examine how human lifestyles affect sustainability.<br><br><b>Remarks/Examples:</b><br>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.17.11</a> , <a href="#">SC.912.L.17.13</a> , <a href="#">SC.912.N.1.3</a> .  |
| <a href="#">SC.912.L.18.1:</a>  | Describe the basic molecular structures and primary functions of the four major categories of biological macromolecules.<br><br><b>Remarks/Examples:</b><br>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.18.11</a> .  |
| <a href="#">SC.912.L.18.6:</a>  | Discuss the role of anaerobic respiration in living things and in human society.  |
| <a href="#">SC.912.L.18.7:</a>  | Identify the reactants, products, and basic functions of photosynthesis.  |

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| <a href="#">SC.912.L.18.8:</a>     | Identify the reactants, products, and basic functions of aerobic and anaerobic cellular respiration.   |
|                                    | Explain the interrelated nature of photosynthesis and cellular respiration.  |
| <a href="#">SC.912.L.18.9:</a>     | <p><b>Remarks/Examples:</b></p> <p>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.18.7</a> <a href="#">SC.912.L.18.8</a> <a href="#">SC.912.L.18.10</a>.</p>   |
| <a href="#">SC.912.L.18.10:</a>    | Connect the role of adenosine triphosphate (ATP) to energy transfers within a cell.  |
| <a href="#">SC.912.L.18.11:</a>    | Explain the role of enzymes as catalysts that lower the activation energy of biochemical reactions. Identify factors, such as pH and temperature, and their effect on enzyme activity.   |
| <a href="#">SC.912.L.18.12:</a>    | Discuss the special properties of water that contribute to Earth's suitability as an environment for life: cohesive behavior, ability to moderate temperature, expansion upon freezing, and versatility as a solvent.  |
|                                    | <p><b>Remarks/Examples:</b></p> <p>Annually assessed on Biology EOC.</p>   |
| <a href="#">MAFS.912.N-Q.1.1:</a>  | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. ★  |
| <a href="#">MAFS.912.N-Q.1.3:</a>  | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. ★  |
| <a href="#">MAFS.912.F-IF.3.7:</a> | <p>Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★</p> <ol style="list-style-type: none"> <li>Graph linear and quadratic functions and show intercepts, maxima, and minima.</li> <li>Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.</li> <li>Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.</li> <li>Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.</li> <li>Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions,</li> </ol> |

showing period, midline, and amplitude, and using phase shift.

[LAFS.1112.RST.1.1:](#)

Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

[LAFS.1112.RST.1.3:](#)

Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

[LAFS.1112.RST.2.4:](#)

Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.

[LAFS.1112.RST.3.7:](#)

Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

[LAFS.910.RST.1.1:](#)

Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

[LAFS.910.RST.1.3:](#)

Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

[LAFS.910.RST.2.4:](#)

Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.

[LAFS.910.RST.2.5:](#)

Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).

[LAFS.910.RST.3.7:](#)

Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

[LAFS.910.RST.4.10:](#)

By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.

[LAFS.910.WHST.1.2:](#)

Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

- a. Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics



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|  | <p>(e.g., figures, tables), and multimedia when useful to aiding comprehension.</p> <ul style="list-style-type: none"> <li>b. Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience’s knowledge of the topic.</li> <li>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts.</li> <li>d. Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.</li> <li>e. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.</li> <li>f. Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).</li> </ul> |
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[LAFS.910.WHST.3.9:](#) Draw evidence from informational texts to support analysis, reflection, and research.

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| <p><a href="#">LAFS.1112.WHST.1.2:</a></p> | <p>Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.</p> <ul style="list-style-type: none"> <li>a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.</li> <li>b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience’s knowledge of the topic.</li> <li>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.</li> <li>d. Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely</li> </ul> |
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|                                     | <p>readers.</p> <p>e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic).</p>   |
| <a href="#">LAFS.1112.WHST.3.9:</a> | Draw evidence from informational texts to support analysis, reflection, and research.  |
| <a href="#">HE.912.C.1.3:</a>       | <p>Evaluate how environment and personal health are interrelated.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/> Food options within a community; prenatal-care services; availability of recreational facilities; air quality; weather-safety awareness; and weather, air, and water conditions.</p> </div>  |
| <a href="#">HE.912.C.1.6:</a>       | <p>Evaluate the relationship between access to health care and health status.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/> Early detection and treatment of cancer, HIV, diabetes, bipolar disorder, schizophrenia, childhood disease or illness, and first-responder care.</p> </div>  |
| <a href="#">HE.912.C.1.8:</a>       | <p>Assess the degree of susceptibility to injury, illness, or death if engaging in unhealthy/risky behaviors.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/> Risks associated with alcohol abuse, including poison, date rape, and death; cancer and chronic lung disease related to tobacco use; overdose from drug use; child abuse or neglect; and dating violence.</p> </div> |
| <a href="#">ELD.K12.ELL.1.1:</a>    | English language learners communicate for social and instructional purposes within the school setting.   |
| <a href="#">ELD.K12.ELL.XX.1:</a>   | English language learners communicate information, ideas and concepts necessary for academic success in the content area of Science.   |

## Biotechnology 1 (#3027010)

**Version for Academic Year:** 2015 - 2016

**Course Number:** 3027010

**Abbreviated Title:** BIOTECH 1

**Number of Credits:** One credit (1)

**Course Length:** Year (Y)

**Course Type:** Core

**Course Level:** 3

**Course Status:** Draft - Course Pending Approval

### GENERAL NOTES

**Credits: 0.5 Science/0.5 CTE**

**Notes:** Laboratory investigations which include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course.

#### **English Language Development ELD Standards Special Notes Section:**

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Science. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/SC.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

### COURSE STANDARDS

| Name                          | Description  |
|-------------------------------|--|
| <a href="#">MA.912.S.1.2:</a> | Determine appropriate and consistent standards of measurement for the data to be collected in a survey or experiment.<br><br><b>Remarks/Examples:</b><br>Example: A student is designing a survey to gauge levels of stress in a |

population of high schools students. Is "stress" something that can be directly measured? How should the student define "stress" so that it can be objectively and consistently measured?

[MA.912.S.3.2:](#)

Collect, organize, and analyze data sets, determine the best format for the data and present visual summaries from the following:

- bar graphs
- line graphs
- stem and leaf plots
- circle graphs
- histograms
- box and whisker plots
- scatter plots
- cumulative frequency (ogive) graphs

**Remarks/Examples:**

Example: Gather data to answer the question: which area of the country has the highest dropout rate? Display your dropout data in appropriate formats. Example: given a set of data, use appropriate technology to sort the data and to display a histogram or other chart.

[LA.910.2.2.3:](#)

The student will organize information to show understanding or relationships among facts, ideas, and events (e.g., representing key points within text through charting, mapping, paraphrasing, summarizing, comparing, contrasting, or outlining);

**Remarks/Examples:**

SS.912.C.4.3      Assess human rights policies of the United States and other countries.

[LA.910.4.2.2:](#)

The student will record information and ideas from primary and/or secondary sources accurately and coherently, noting the validity and reliability of these sources and attributing sources of information;

[SC.912.N.1.1:](#)

Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:

1. **Pose questions about the natural world,** (Articulate the purpose of the investigation and identify the relevant scientific concepts).
2. **Conduct systematic observations,** (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct

and record measurements at appropriate levels of precision. Follow safety guidelines).

3. **Examine books and other sources of information to see what is already known,**
4. **Review what is known in light of empirical evidence,** (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).
5. **Plan investigations,** (Design and evaluate a scientific investigation).
6. **Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),** (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).
7. **Pose answers, explanations, or descriptions of events,**
8. **Generate explanations that explicate or describe natural phenomena (inferences),**
9. **Use appropriate evidence and reasoning to justify these explanations to others,**
10. **Communicate results of scientific investigations, and**
11. **Evaluate the merits of the explanations produced by others.**

**Remarks/Examples:**

Florida Standards Connections for 6-12 Literacy in Science

For Students in Grades 9-10

LAFS.910.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.

LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or

technical processes.

LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.

For Students in Grades 11-12

LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks analyze the specific results based on explanations in the text.

LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.

Florida Standards Connections for Mathematical Practices

MAFS.K12.MP.1: Make sense of problems and persevere in solving them.

MAFS.K12.MP.2: Reason abstractly and quantitatively.

MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]

MAFS.K12.MP.4: Model with mathematics.

MAFS.K12.MP.5: Use appropriate tools strategically.

MAFS.K12.MP.6: Attend to precision.

MAFS.K12.MP.7: Look for and make use of structure.

MAFS.K12.MP.8: Look for and express regularity in repeated reasoning.

Describe and explain what characterizes science and its methods.

[SC.912.N.1.2:](#)

**Remarks/Examples:**

Science is characterized by empirical observations, testable questions,

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|                                      | <p>formation of hypotheses, and experimentation that results in stable and replicable results, logical reasoning, and coherent theoretical constructs.</p> <p>Florida Standards Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others.</p>   |
| <p><a href="#">SC.912.N.1.3:</a></p> | <p>Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented.</p> <p><b>Remarks/Examples:</b><br/>Assess the reliability of data and identify reasons for inconsistent results, such as sources of error or uncontrolled conditions.</p> <p>Florida Standards Connections: MAFS.K12.MP.2: Reason abstractly and quantitatively MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others</p>                             |
| <p><a href="#">SC.912.N.1.4:</a></p> | <p>Identify sources of information and assess their reliability according to the strict standards of scientific investigation.</p> <p><b>Remarks/Examples:</b><br/>Read, interpret, and examine the credibility and validity of scientific claims in different sources of information, such as scientific articles, advertisements, or media stories. Strict standards of science include controlled variables, sufficient sample size, replication of results, empirical and measurable evidence, and the concept of falsification.</p> <p>Florida Standards Connections: <a href="#">LAFS.910.RST.1.1</a> / <a href="#">LAFS.1112.RST.1.1</a>.</p> |
| <p><a href="#">SC.912.N.1.6:</a></p> | <p>Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.</p> <p><b>Remarks/Examples:</b><br/>Collect data/evidence and use tables/graphs to draw conclusions and make inferences based on patterns or trends in the data.</p> <p>Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them.</p>  |
| <p><a href="#">SC.912.N.2.1:</a></p> | <p>Identify what is science, what clearly is not science, and what superficially resembles science (but fails to meet the criteria for science).</p>   |

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|                                      | <p><b>Remarks/Examples:</b><br/> Science is the systematic and organized inquiry that is derived from observations and experimentation that can be verified or tested by further investigation to explain natural phenomena (e.g. Science is testable, pseudo-science is not science seeks falsifications, pseudo-science seeks confirmations.)</p>   |
| <p><a href="#">SC.912.N.2.2:</a></p> | <p>Identify which questions can be answered through science and which questions are outside the boundaries of scientific investigation, such as questions addressed by other ways of knowing, such as art, philosophy, and religion.</p> <p><b>Remarks/Examples:</b><br/> Identify scientific questions that can be disproved by experimentation/testing. Recognize that pseudoscience is a claim, belief, or practice which is presented as scientific, but does not adhere to strict standards of science (e.g. controlled variables, sample size, replicability, empirical and measurable evidence, and the concept of falsification).</p> <p>Florida Standards Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others.</p> |
| <p><a href="#">SC.912.N.3.1:</a></p> | <p>Explain that a scientific theory is the culmination of many scientific investigations drawing together all the current evidence concerning a substantial range of phenomena; thus, a scientific theory represents the most powerful explanation scientists have to offer.</p> <p><b>Remarks/Examples:</b><br/> Explain that a scientific theory is a well-tested hypothesis supported by a preponderance of empirical evidence.</p> <p>Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them and, MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others.</p>   |
| <p><a href="#">SC.912.N.3.4:</a></p> | <p>Recognize that theories do not become laws, nor do laws become theories; theories are well supported explanations and laws are well supported descriptions.</p> <p><b>Remarks/Examples:</b><br/> Recognize that theories do not become laws, theories explain laws. Recognize that not all scientific laws have accompanying explanatory theories.</p>   |
| <p><a href="#">SC.912.N.4.1:</a></p> | <p>Explain how scientific knowledge and reasoning provide an empirically-</p>   |



based perspective to inform society's decision making.

**Remarks/Examples:**

Recognize that no single universal step-by-step scientific method captures the complexity of doing science. A number of shared values and perspectives characterize a scientific approach.

MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively.

Weigh the merits of alternative strategies for solving a specific societal problem by comparing a number of different costs and benefits, such as human, economic, and environmental.

[SC.912.N.4.2:](#)

**Remarks/Examples:**

Identify examples of technologies, objects, and processes that have been modified to advance society, and explain why and how they were modified. Discuss ethics in scientific research to advance society (e.g. global climate change, historical development of medicine and medical practices).

Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively.

Analyze past, present, and potential future consequences to the environment resulting from various energy production technologies.

[SC.912.E.6.6:](#)

**Remarks/Examples:**

Investigate and discuss how humans affect and are affected by geological systems and processes by describing the possible long-term consequences (costs and benefits) that increased human consumption (e.g. mining and extraction techniques off-shore drilling petrochemical refining) has placed on the environment (e.g. pollution, health, habitat destruction) and the impact on future energy production.

Describe the properties of the carbon atom that make the diversity of carbon compounds possible.

[SC.912.P.8.12:](#)

**Remarks/Examples:**

Explain how the bonding characteristics of carbon lead to a large variety of structures ranging from simple hydrocarbons to complex polymers and biological molecules.

[SC.912.P.10.15:](#)

Investigate and explain the relationships among current, voltage, resistance, and power.

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|  | <p><b>Remarks/Examples:</b></p> <p>Use Ohm's and Kirchoff's laws to explain the relationships among circuits.</p>  |
| <p><a href="#">SC.912.P.12.12:</a></p> | <p>Explain how various factors, such as concentration, temperature, and presence of a catalyst affect the rate of a chemical reaction.</p> <p><b>Remarks/Examples:</b></p> <p>Various factors could include: temperature, pressure, solvent and/or solute concentration, sterics, surface area, and catalysts. The rate of reaction is determined by the activation energy, and the pathway of the reaction can be shorter in the presence of enzymes or catalysts. Examples may include: decomposition of hydrogen peroxide using manganese (IV) oxide nitration of benzene using concentrated sulfuric acid hydrogenation of a C=C double bond using nickel.</p> |
| <p><a href="#">SC.912.L.14.4:</a></p>  | <p>Compare and contrast structure and function of various types of microscopes.</p>  |
| <p><a href="#">SC.912.L.14.1:</a></p>  | <p>Describe the scientific theory of cells (cell theory) and relate the history of its discovery to the process of science.</p> <p><b>Remarks/Examples:</b></p> <p>Describe how continuous investigations and/or new scientific information influenced the development of the cell theory. Recognize the contributions of scientists in the development of the cell theory.</p>  |
| <p><a href="#">SC.912.L.14.2:</a></p>  | <p>Relate structure to function for the components of plant and animal cells. Explain the role of cell membranes as a highly selective barrier (passive and active transport).</p>   |
| <p><a href="#">SC.912.L.14.3:</a></p>  | <p>Compare and contrast the general structures of plant and animal cells. Compare and contrast the general structures of prokaryotic and eukaryotic cells.</p> <p><b>Remarks/Examples:</b></p> <p>Annually Assessed on Biology EOC. Also assesses <a href="#">SC.912.L.14.2</a>.</p>   |
| <p><a href="#">SC.912.L.14.6:</a></p>  | <p>Explain the significance of genetic factors, environmental factors, and pathogenic agents to health from the perspectives of both individual and public health.</p>   |
| <p><a href="#">SC.912.L.15.1:</a></p>  | <p>Explain how the scientific theory of evolution is supported by the fossil record, comparative anatomy, comparative embryology, biogeography, molecular biology, and observed evolutionary change.</p> <p><b>Remarks/Examples:</b></p>   |

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|                                 | <p>Annually Assessed on Biology EOC. Also assesses <a href="#">SC.912.L.15.10</a> <a href="#">SC.912.N.1.3</a> <a href="#">SC.912.N.1.4</a> <a href="#">SC.912.N.1.6</a> <a href="#">SC.912.N.2.1</a> <a href="#">SC.912.N.3.1</a> and <a href="#">SC.912.N.3.4</a>.</p>                      |
| <a href="#">SC.912.L.15.4:</a>  | Describe how and why organisms are hierarchically classified and based on evolutionary relationships.   |
| <a href="#">SC.912.L.15.5:</a>  | Explain the reasons for changes in how organisms are classified.  |
|                                 | Discuss distinguishing characteristics of the domains and kingdoms of living organisms.   |
| <a href="#">SC.912.L.15.6:</a>  | <p><b>Remarks/Examples:</b></p> <p>Annually Assessed on Biology EOC. Also assesses <a href="#">SC.912.L.15.4</a> <a href="#">SC.912.L.15.5</a> <a href="#">SC.912.N.1.3</a> and <a href="#">SC.912.N.1.6</a>.</p>   |
|                                 | Describe the scientific explanations of the origin of life on Earth.  |
| <a href="#">SC.912.L.15.8:</a>  | <p><b>Remarks/Examples:</b></p> <p>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.N.1.3</a>, <a href="#">SC.912.N.1.4</a>, and <a href="#">SC.912.N.2.1</a>.</p>  |
| <a href="#">SC.912.L.15.15:</a> | Describe how mutation and genetic recombination increase genetic variation.   |
|                                 | Use Mendel's laws of segregation and independent assortment to analyze patterns of inheritance.   |
| <a href="#">SC.912.L.16.1:</a>  | <p><b>Remarks/Examples:</b></p> <p>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.16.2</a>.</p>   |
| <a href="#">SC.912.L.16.2:</a>  | Discuss observed inheritance patterns caused by various modes of inheritance, including dominant, recessive, codominant, sex-linked, polygenic, and multiple alleles.   |
| <a href="#">SC.912.L.16.9:</a>  | Explain how and why the genetic code is universal and is common to almost all organisms.  |
|                                 | Describe the basic process of DNA replication and how it relates to the transmission and conservation of the genetic information.   |
| <a href="#">SC.912.L.16.3:</a>  | <p><b>Remarks/Examples:</b></p> <p>Integrate <a href="#">HE.912.C.1.7</a>. Analyze how heredity and family history can impact personal health. Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.16.4</a> <a href="#">SC.912.L.16.5</a> <a href="#">SC.912.L.16.9</a>.</p> |
| <a href="#">SC.912.L.16.4:</a>  | Explain how mutations in the DNA sequence may or may not result in phenotypic change. Explain how mutations in gametes may result in phenotypic changes in offspring.   |

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| <a href="#">SC.912.L.16.5:</a>  | Explain the basic processes of transcription and translation, and how they result in the expression of genes.  |
| <a href="#">SC.912.L.16.6:</a>  | Discuss the mechanisms for regulation of gene expression in prokaryotes and eukaryotes at transcription and translation level.   |
| <a href="#">SC.912.L.16.7:</a>  | Describe how viruses and bacteria transfer genetic material between cells and the role of this process in biotechnology.   |
| <a href="#">SC.912.L.16.8:</a>  | <p>Explain the relationship between mutation, cell cycle, and uncontrolled cell growth potentially resulting in cancer.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b></p> <p>Integrate <a href="#">HE.912.C.1.7</a>. Analyze how heredity and family history can impact personal health.</p> </div>   |
| <a href="#">SC.912.L.16.10:</a> | <p>Evaluate the impact of biotechnology on the individual, society and the environment, including medical and ethical issues.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b></p> <p>Annually assessed on Biology EOC.</p> </div>   |
| <a href="#">SC.912.L.16.11:</a> | Discuss the technologies associated with forensic medicine and DNA identification, including restriction fragment length polymorphism (RFLP) analysis.   |
| <a href="#">SC.912.L.16.12:</a> | Describe how basic DNA technology (restriction digestion by endonucleases, gel electrophoresis, polymerase chain reaction, ligation, and transformation) is used to construct recombinant DNA molecules (DNA cloning).   |
| <a href="#">SC.912.L.16.14:</a> | Describe the cell cycle, including the process of mitosis. Explain the role of mitosis in the formation of new cells and its importance in maintaining chromosome number during asexual reproduction.  |
| <a href="#">SC.912.L.16.16:</a> | Describe the process of meiosis, including independent assortment and crossing over. Explain how reduction division results in the formation of haploid gametes or spores.   |
| <a href="#">SC.912.L.16.17:</a> | <p>Compare and contrast mitosis and meiosis and relate to the processes of sexual and asexual reproduction and their consequences for genetic variation.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b></p> <p>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.16.8</a> <a href="#">SC.912.L.16.14</a> <a href="#">SC.912.L.16.16</a>.</p> </div> |
| <a href="#">SC.912.L.17.17:</a> | Assess the effectiveness of innovative methods of protecting the environment.  |
| <a href="#">SC.912.L.18.1:</a>  | Describe the basic molecular structures and primary functions of the four major categories of biological macromolecules.   |

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|                                   | <p><b>Remarks/Examples:</b><br/>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.18.11</a>.</p>  |
| <a href="#">SC.912.L.18.4:</a>    | Describe the structures of proteins and amino acids. Explain the functions of proteins in living organisms. Identify some reactions that amino acids undergo. Relate the structure and function of enzymes.  |
| <a href="#">SC.912.L.18.6:</a>    | Discuss the role of anaerobic respiration in living things and in human society.   |
| <a href="#">SC.912.L.18.7:</a>    | Identify the reactants, products, and basic functions of photosynthesis.   |
| <a href="#">SC.912.L.18.8:</a>    | Identify the reactants, products, and basic functions of aerobic and anaerobic cellular respiration.   |
| <a href="#">SC.912.L.18.10:</a>   | Connect the role of adenosine triphosphate (ATP) to energy transfers within a cell.  |
| <a href="#">SC.912.L.18.11:</a>   | Explain the role of enzymes as catalysts that lower the activation energy of biochemical reactions. Identify factors, such as pH and temperature, and their effect on enzyme activity.   |
| <a href="#">SC.912.L.18.12:</a>   | <p>Discuss the special properties of water that contribute to Earth's suitability as an environment for life: cohesive behavior, ability to moderate temperature, expansion upon freezing, and versatility as a solvent.</p> <p><b>Remarks/Examples:</b><br/>Annually assessed on Biology EOC.</p> |
| <a href="#">HE.912.C.1.3:</a>     | <p>Evaluate how environment and personal health are interrelated.</p> <p><b>Remarks/Examples:</b><br/>Some examples may include food options within a community, prenatal care services, availability of recreational facilities.</p>  |
| <a href="#">HE.912.C.1.4:</a>     | <p>Analyze how heredity and family history can impact personal health.</p> <p><b>Remarks/Examples:</b><br/>Some examples may include drug use, family obesity, heart disease, mental health, and non-communicable illness or disease.</p>  |
| <a href="#">ELD.K12.ELL.1.1:</a>  | English language learners communicate for social and instructional purposes within the school setting.   |
| <a href="#">ELD.K12.ELL.XX.1:</a> | English language learners communicate information, ideas and concepts necessary for academic success in the content area of Science.   |

## Biotechnology 2 (#3027020)

**Version for Academic Year:** 2015 - 2016

**Course Number:** 3027020

**Abbreviated Title:** BIOTECH 2

**Number of Credits:** One credit (1)

**Course Length:** Year (Y)

**Course Type:** Core

**Course Level:** 3

**Course Status:** Draft - Course Pending Approval

### GENERAL NOTES

**Credits: 0.5 Science/0.5 CTE**

**Notes:** Laboratory investigations which include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course.

### English Language Development ELD Standards Special Notes Section:

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Science. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/SC.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

### COURSE STANDARDS

| Name                          | Description   |
|-------------------------------|---|
| <a href="#">MA.912.S.1.2:</a> | Determine appropriate and consistent standards of measurement for the data to be collected in a survey or experiment. |

**Remarks/Examples:**

Example: A student is designing a survey to gauge levels of stress in a population of high schools students. Is "stress" something that can be directly measured? How should the student define "stress" so that it can be objectively and consistently measured?

[MA.912.S.3.2:](#)

Collect, organize, and analyze data sets, determine the best format for the data and present visual summaries from the following:

- bar graphs
- line graphs
- stem and leaf plots
- circle graphs
- histograms
- box and whisker plots
- scatter plots
- cumulative frequency (ogive) graphs

**Remarks/Examples:**

Example: Gather data to answer the question: which area of the country has the highest dropout rate? Display your dropout data in appropriate formats. Example: given a set of data, use appropriate technology to sort the data and to display a histogram or other chart.

[LA.910.2.2.3:](#)

The student will organize information to show understanding or relationships among facts, ideas, and events (e.g., representing key points within text through charting, mapping, paraphrasing, summarizing, comparing, contrasting, or outlining);

**Remarks/Examples:**

SS.912.C.4.3 Assess human rights policies of the United States and other countries.

[LA.910.4.2.2:](#)

The student will record information and ideas from primary and/or secondary sources accurately and coherently, noting the validity and reliability of these sources and attributing sources of information;

Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:

[SC.912.N.1.1:](#)

1. **Pose questions about the natural world**, (Articulate the purpose of the investigation and identify the relevant scientific concepts).
2. **Conduct systematic observations**, (Write procedures that are clear and replicable. Identify observables and examine relationships between

test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).

3. **Examine books and other sources of information to see what is already known,**
4. **Review what is known in light of empirical evidence,** (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).
5. **Plan investigations,** (Design and evaluate a scientific investigation).
6. **Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),** (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).
7. **Pose answers, explanations, or descriptions of events,**
8. **Generate explanations that explicate or describe natural phenomena (inferences),**
9. **Use appropriate evidence and reasoning to justify these explanations to others,**
10. **Communicate results of scientific investigations, and**
11. **Evaluate the merits of the explanations produced by others.**

**Remarks/Examples:**

Florida Standards Connections for 6-12 Literacy in Science

For Students in Grades 9-10

LAFS.910.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.

LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.



LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.

For Students in Grades 11-12

LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks analyze the specific results based on explanations in the text.

LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.

Florida Standards Connections for Mathematical Practices

MAFS.K12.MP.1: Make sense of problems and persevere in solving them.

MAFS.K12.MP.2: Reason abstractly and quantitatively.

MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]

MAFS.K12.MP.4: Model with mathematics.

MAFS.K12.MP.5: Use appropriate tools strategically.

MAFS.K12.MP.6: Attend to precision.

MAFS.K12.MP.7: Look for and make use of structure.

MAFS.K12.MP.8: Look for and express regularity in repeated reasoning.

[SC.912.N.1.3:](#)

Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical

thinking, and the active consideration of alternative scientific explanations to explain the data presented.

**Remarks/Examples:**

Assess the reliability of data and identify reasons for inconsistent results, such as sources of error or uncontrolled conditions.

Florida Standards Connections: MAFS.K12.MP.2: Reason abstractly and quantitatively MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others

Identify sources of information and assess their reliability according to the strict standards of scientific investigation.

[SC.912.N.1.4:](#)

**Remarks/Examples:**

Read, interpret, and examine the credibility and validity of scientific claims in different sources of information, such as scientific articles, advertisements, or media stories. Strict standards of science include controlled variables, sufficient sample size, replication of results, empirical and measurable evidence, and the concept of falsification.

Florida Standards Connections: [LAFS.910.RST.1.1](#) / [LAFS.1112.RST.1.1](#).

Describe and provide examples of how similar investigations conducted in many parts of the world result in the same outcome.

[SC.912.N.1.5:](#)

**Remarks/Examples:**

Recognize that contributions to science can be made and have been made by people from all over the world.

Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.

[SC.912.N.1.6:](#)

**Remarks/Examples:**

Collect data/evidence and use tables/graphs to draw conclusions and make inferences based on patterns or trends in the data.

Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them.

Recognize the role of creativity in constructing scientific questions, methods and explanations.

[SC.912.N.1.7:](#)

**Remarks/Examples:**

Work through difficult problems using creativity, and critical and analytical thinking in problem solving (e.g. convergent versus

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|                                      | <p>divergent thinking and creativity in problem solving).</p> <p>Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them and MAFS.K12.MP.2: Reason abstractly and quantitatively.</p>  |
| <p><a href="#">SC.912.N.4.1:</a></p> | <p>Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making.</p> <p><b>Remarks/Examples:</b><br/>Recognize that no single universal step-by-step scientific method captures the complexity of doing science. A number of shared values and perspectives characterize a scientific approach.</p> <p>MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively.</p>   |
| <p><a href="#">SC.912.N.4.2:</a></p> | <p>Weigh the merits of alternative strategies for solving a specific societal problem by comparing a number of different costs and benefits, such as human, economic, and environmental.</p> <p><b>Remarks/Examples:</b><br/>Identify examples of technologies, objects, and processes that have been modified to advance society, and explain why and how they were modified. Discuss ethics in scientific research to advance society (e.g. global climate change, historical development of medicine and medical practices).</p> <p>Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively.</p> |
| <p><a href="#">SC.912.E.6.6:</a></p> | <p>Analyze past, present, and potential future consequences to the environment resulting from various energy production technologies.</p> <p><b>Remarks/Examples:</b><br/>Investigate and discuss how humans affect and are affected by geological systems and processes by describing the possible long-term consequences (costs and benefits) that increased human consumption (e.g. mining and extraction techniques off-shore drilling petrochemical refining) has placed on the environment (e.g. pollution, health, habitat destruction) and the impact on future energy production.</p>  |
| <p><a href="#">SC.912.E.7.1:</a></p> | <p>Analyze the movement of matter and energy through the different biogeochemical cycles, including water and carbon.</p>   |

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|  | <p><b>Remarks/Examples:</b><br/>Describe that the Earth system contains fixed amounts of each stable chemical element and that each element moves among reservoirs in the solid earth, oceans, atmosphere and living organisms as part of biogeochemical cycles (i.e., nitrogen, water, carbon, oxygen and phosphorus), which are driven by energy from within the Earth and from the Sun.</p>  |
| <p><a href="#">SC.912.P.12.12:</a></p> | <p>Explain how various factors, such as concentration, temperature, and presence of a catalyst affect the rate of a chemical reaction.</p> <p><b>Remarks/Examples:</b><br/>Various factors could include: temperature, pressure, solvent and/or solute concentration, sterics, surface area, and catalysts. The rate of reaction is determined by the activation energy, and the pathway of the reaction can be shorter in the presence of enzymes or catalysts. Examples may include: decomposition of hydrogen peroxide using manganese (IV) oxide nitration of benzene using concentrated sulfuric acid hydrogenation of a C=C double bond using nickel.</p> |
| <p><a href="#">SC.912.L.14.4:</a></p>  | <p>Compare and contrast structure and function of various types of microscopes.</p>   |
| <p><a href="#">SC.912.L.14.1:</a></p>  | <p>Describe the scientific theory of cells (cell theory) and relate the history of its discovery to the process of science.</p> <p><b>Remarks/Examples:</b><br/>Describe how continuous investigations and/or new scientific information influenced the development of the cell theory. Recognize the contributions of scientists in the development of the cell theory.</p>  |
| <p><a href="#">SC.912.L.14.2:</a></p>  | <p>Relate structure to function for the components of plant and animal cells. Explain the role of cell membranes as a highly selective barrier (passive and active transport).</p>  |
| <p><a href="#">SC.912.L.14.3:</a></p>  | <p>Compare and contrast the general structures of plant and animal cells. Compare and contrast the general structures of prokaryotic and eukaryotic cells.</p> <p><b>Remarks/Examples:</b><br/>Annually Assessed on Biology EOC. Also assesses <a href="#">SC.912.L.14.2</a>.</p>   |
| <p><a href="#">SC.912.L.14.6:</a></p>  | <p>Explain the significance of genetic factors, environmental factors, and pathogenic agents to health from the perspectives of both individual and public health.</p>  |
| <p><a href="#">SC.912.L.14.7:</a></p>  | <p>Relate the structure of each of the major plant organs and tissues to physiological processes.</p>   |

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|                                 | <p><b>Remarks/Examples:</b><br/>Annually Assessed on Biology EOC.</p>   |
| <a href="#">SC.912.L.14.26:</a> | <p>Identify the major parts of the brain on diagrams or models.</p> <p><b>Remarks/Examples:</b><br/>Annually Assessed on Biology EOC.<br/>Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.</p>   |
| <a href="#">SC.912.L.14.36:</a> | Describe the factors affecting blood flow through the cardiovascular system.  |
| <a href="#">SC.912.L.14.37:</a> | Explain the components of an electrocardiogram.   |
| <a href="#">SC.912.L.14.52:</a> | <p>Explain the basic functions of the human immune system, including specific and nonspecific immune response, vaccines, and antibiotics.</p> <p><b>Remarks/Examples:</b><br/>Annually Assessed on Biology EOC. Also assesses <a href="#">SC.912.L.14.6</a>, <a href="#">HE.912.C.1.7</a> and <a href="#">HE.912.C.1.5</a>.</p>   |
| <a href="#">SC.912.L.15.1:</a>  | <p>Explain how the scientific theory of evolution is supported by the fossil record, comparative anatomy, comparative embryology, biogeography, molecular biology, and observed evolutionary change.</p> <p><b>Remarks/Examples:</b><br/>Annually Assessed on Biology EOC. Also assesses <a href="#">SC.912.L.15.10</a>, <a href="#">SC.912.N.1.3</a>, <a href="#">SC.912.N.1.4</a>, <a href="#">SC.912.N.1.6</a>, <a href="#">SC.912.N.2.1</a>, <a href="#">SC.912.N.3.1</a> and <a href="#">SC.912.N.3.4</a>.</p> |
| <a href="#">SC.912.L.15.10:</a> | Identify basic trends in hominid evolution from early ancestors six million years ago to modern humans, including brain size, jaw size, language, and manufacture of tools.   |
| <a href="#">SC.912.L.15.13:</a> | <p>Describe the conditions required for natural selection, including: overproduction of offspring, inherited variation, and the struggle to survive, which result in differential reproductive success.</p> <p><b>Remarks/Examples:</b><br/>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.15.14</a>, <a href="#">SC.912.L.15.15</a>, and <a href="#">SC.912.N.1.3</a>.</p>   |
| <a href="#">SC.912.L.15.14:</a> | Discuss mechanisms of evolutionary change other than natural selection such as genetic drift and gene flow.   |
| <a href="#">SC.912.L.16.3:</a>  | Describe the basic process of DNA replication and how it relates to the transmission and conservation of the genetic information.   |

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|                                 | <p><b>Remarks/Examples:</b><br/>Integrate <a href="#">HE.912.C.1.7</a>. Analyze how heredity and family history can impact personal health. Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.16.4</a> <a href="#">SC.912.L.16.5</a> <a href="#">SC.912.L.16.9</a>.</p>  |
| <a href="#">SC.912.L.16.4:</a>  | Explain how mutations in the DNA sequence may or may not result in phenotypic change. Explain how mutations in gametes may result in phenotypic changes in offspring.   |
| <a href="#">SC.912.L.16.5:</a>  | Explain the basic processes of transcription and translation, and how they result in the expression of genes.   |
| <a href="#">SC.912.L.16.6:</a>  | Discuss the mechanisms for regulation of gene expression in prokaryotes and eukaryotes at transcription and translation level.  |
| <a href="#">SC.912.L.16.7:</a>  | Describe how viruses and bacteria transfer genetic material between cells and the role of this process in biotechnology.  |
| <a href="#">SC.912.L.16.10:</a> | <p>Evaluate the impact of biotechnology on the individual, society and the environment, including medical and ethical issues.</p> <p><b>Remarks/Examples:</b><br/>Annually assessed on Biology EOC.</p>   |
| <a href="#">SC.912.L.16.11:</a> | Discuss the technologies associated with forensic medicine and DNA identification, including restriction fragment length polymorphism (RFLP) analysis.  |
| <a href="#">SC.912.L.16.12:</a> | Describe how basic DNA technology (restriction digestion by endonucleases, gel electrophoresis, polymerase chain reaction, ligation, and transformation) is used to construct recombinant DNA molecules (DNA cloning).  |
| <a href="#">SC.912.L.16.13:</a> | <p>Describe the basic anatomy and physiology of the human reproductive system. Describe the process of human development from fertilization to birth and major changes that occur in each trimester of pregnancy.</p> <p><b>Remarks/Examples:</b><br/>Annually assessed on Biology EOC.</p> |
| <a href="#">SC.912.L.17.14:</a> | Assess the need for adequate waste management strategies.   |
| <a href="#">SC.912.L.17.15:</a> | Discuss the effects of technology on environmental quality.   |
| <a href="#">SC.912.L.17.12:</a> | <p>Discuss the political, social, and environmental consequences of sustainable use of land.</p> <p><b>Remarks/Examples:</b><br/>Integrate <a href="#">HE.912.C.1.3</a>. Evaluate how environment and personal health are interrelated.</p>   |

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| <a href="#">SC.912.L.17.2:</a>  | Explain the general distribution of life in aquatic systems as a function of chemistry, geography, light, depth, salinity, and temperature.   |
| <a href="#">SC.912.L.17.3:</a>  | Discuss how various oceanic and freshwater processes, such as currents, tides, and waves, affect the abundance of aquatic organisms.  |
| <a href="#">SC.912.L.17.4:</a>  | Describe changes in ecosystems resulting from seasonal variations, climate change and succession.   |
| <a href="#">SC.912.L.17.5:</a>  | Analyze how population size is determined by births, deaths, immigration, emigration, and limiting factors (biotic and abiotic) that determine carrying capacity.<br><div style="border: 1px solid black; padding: 5px;"><b>Remarks/Examples:</b><br/>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.17.2</a> <a href="#">SC.912.L.17.4</a> <a href="#">SC.912.L.17.8</a> <a href="#">SC.912.N.1.4</a>.</div>   |
| <a href="#">SC.912.L.17.8:</a>  | Recognize the consequences of the losses of biodiversity due to catastrophic events, climate changes, human activity, and the introduction of invasive, non-native species.   |
| <a href="#">SC.912.L.17.9:</a>  | Use a food web to identify and distinguish producers, consumers, and decomposers. Explain the pathway of energy transfer through trophic levels and the reduction of available energy at successive trophic levels.<br><div style="border: 1px solid black; padding: 5px;"><b>Remarks/Examples:</b><br/>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.E.7.1</a>.</div>   |
| <a href="#">SC.912.L.17.10:</a> | Diagram and explain the biogeochemical cycles of an ecosystem, including water, carbon, and nitrogen cycle.   |
| <a href="#">SC.912.L.17.11:</a> | Evaluate the costs and benefits of renewable and nonrenewable resources, such as water, energy, fossil fuels, wildlife, and forests.  |
| <a href="#">SC.912.L.17.13:</a> | Discuss the need for adequate monitoring of environmental parameters when making policy decisions.  |
| <a href="#">SC.912.L.17.16:</a> | Discuss the large-scale environmental impacts resulting from human activity, including waste spills, oil spills, runoff, greenhouse gases, ozone depletion, and surface and groundwater pollution.<br><div style="border: 1px solid black; padding: 5px;"><b>Remarks/Examples:</b><br/>Integrate <a href="#">HE.912.C.1.3</a>. Evaluate how environment and personal health are interrelated and, <a href="#">HE.912.C.1.5</a>. Analyze strategies for prevention, detection, and treatment of communicable and chronic diseases.</div> |
| <a href="#">SC.912.L.17.20:</a> | Predict the impact of individuals on environmental systems and examine how human lifestyles affect sustainability.<br><div style="border: 1px solid black; padding: 5px;"><b>Remarks/Examples:</b></div>  |

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|-----------------------------------|---|
|                                   | Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.17.11</a> , <a href="#">SC.912.L.17.13</a> , <a href="#">SC.912.N.1.3</a> .  |
| <a href="#">SC.912.L.18.1:</a>    | Describe the basic molecular structures and primary functions of the four major categories of biological macromolecules.<br><b>Remarks/Examples:</b><br>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.18.11</a> .                |
| <a href="#">SC.912.L.18.6:</a>    | Discuss the role of anaerobic respiration in living things and in human society.  |
| <a href="#">SC.912.L.18.9:</a>    | Explain the interrelated nature of photosynthesis and cellular respiration.<br><b>Remarks/Examples:</b><br>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.18.7</a> <a href="#">SC.912.L.18.8</a> <a href="#">SC.912.L.18.10</a> . |
| <a href="#">SC.912.L.18.11:</a>   | Explain the role of enzymes as catalysts that lower the activation energy of biochemical reactions. Identify factors, such as pH and temperature, and their effect on enzyme activity.  |
| <a href="#">HE.912.C.1.3:</a>     | Evaluate how environment and personal health are interrelated.<br><b>Remarks/Examples:</b><br>Some examples may include food options within a community, prenatal care services, availability of recreational facilities.                               |
| <a href="#">HE.912.C.1.4:</a>     | Analyze how heredity and family history can impact personal health.<br><b>Remarks/Examples:</b><br>Some examples may include drug use, family obesity, heart disease, mental health, and non-communicable illness or disease.                           |
| <a href="#">ELD.K12.ELL.1.1:</a>  | English language learners communicate for social and instructional purposes within the school setting.  |
| <a href="#">ELD.K12.ELL.XX.1:</a> | English language learners communicate information, ideas and concepts necessary for academic success in the content area of Science.  |



## **Botany (#2000370)**

**Version for Academic Year:** 2015 - 2016

**Course Number:** 2000370

**Abbreviated Title:** BOTANY

**Number of Credits:** One credit (1)

**Course Length:** Year (Y)

**Course Type:** Core

**Course Level:** 2

**Course Status:** Draft - Course Pending Approval

**Grade Level(s):** 9,10,11,12

### **GENERAL NOTES**

Laboratory investigations that include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of this course. The National Science Teachers Association (NSTA) recommends that at the high school level, all students should be in the science lab or field, collecting data every week. School laboratory investigations (labs) are defined by the National Research Council (NRC) as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC, 2006, p. 3). Laboratory investigations in the high school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (National Research Council, 2006, p.77; NSTA, 2007).

### **Special Notes:**

#### **Instructional Practices**

Teaching from a range of complex text is optimized when teachers in all subject areas implement the following strategies on a routine basis:

1. Ensuring wide reading from complex text that varies in length.
2. Making close reading and rereading of texts central to lessons.
3. Emphasizing text-specific complex questions, and cognitively complex tasks, reinforce focus on the text and cultivate independence.
4. Emphasizing students supporting answers based upon evidence from the text.
5. Providing extensive research and writing opportunities (claims and evidence).

### English Language Development ELD Standards Special Notes Section:

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Science. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<http://www.cpalms.org/uploads/docs/standards/eld/SC.pdf>

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at [sala@fldoe.org](mailto:sala@fldoe.org).

### COURSE STANDARDS

#### Integrate Standards for Mathematical Practice (MP) as applicable.

- MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
- MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
- MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
- MAFS.K12.MP.4.1 Model with mathematics.
- MAFS.K12.MP.5.1 Use appropriate tools strategically.
- MAFS.K12.MP.6.1 Attend to precision.
- MAFS.K12.MP.7.1 Look for and make use of structure.
- MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

| Name                          | Description   |
|-------------------------------|---|
| <a href="#">SC.912.N.1.1:</a> | Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:<br><br><ol style="list-style-type: none"><li>1. <b>Pose questions about the natural world,</b> (Articulate the purpose of the investigation and identify the relevant scientific concepts).</li><li>2. <b>Conduct systematic observations,</b> (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).</li></ol> |

3. **Examine books and other sources of information to see what is already known,**
4. **Review what is known in light of empirical evidence,** (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).
5. **Plan investigations,** (Design and evaluate a scientific investigation).
6. **Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),** (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).
7. **Pose answers, explanations, or descriptions of events,**
8. **Generate explanations that explicate or describe natural phenomena (inferences),**
9. **Use appropriate evidence and reasoning to justify these explanations to others,**
10. **Communicate results of scientific investigations, and**
11. **Evaluate the merits of the explanations produced by others.**

**Remarks/Examples:**

Florida Standards Connections for 6-12 Literacy in Science

For Students in Grades 9-10

LAFS.910.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.

LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into

words.

LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.

For Students in Grades 11-12

LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks analyze the specific results based on explanations in the text.

LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.

Florida Standards Connections for Mathematical Practices

MAFS.K12.MP.1: Make sense of problems and persevere in solving them.

MAFS.K12.MP.2: Reason abstractly and quantitatively.

MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]

MAFS.K12.MP.4: Model with mathematics.

MAFS.K12.MP.5: Use appropriate tools strategically.

MAFS.K12.MP.6: Attend to precision.

MAFS.K12.MP.7: Look for and make use of structure.  
MAFS.K12.MP.8: Look for and express regularity in repeated reasoning.

Describe and explain what characterizes science and its methods.

[SC.912.N.1.2:](#)

**Remarks/Examples:**

Science is characterized by empirical observations, testable questions, formation of hypotheses, and experimentation that results in stable and replicable results, logical reasoning, and coherent theoretical constructs.

Florida Standards Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others.

Explain that scientific knowledge is both durable and robust and open to change. Scientific knowledge can change because it is often examined and re-examined by new investigations and scientific argumentation. Because of these frequent examinations, scientific knowledge becomes stronger, leading to its durability.

[SC.912.N.2.4:](#)

**Remarks/Examples:**

Recognize that ideas with the most durable explanatory power become established theories, but scientific explanations are continually subjected to change in the face of new evidence.

Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them  
MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others.

Describe the properties of the carbon atom that make the diversity of carbon compounds possible.

[SC.912.P.8.12:](#)

**Remarks/Examples:**

Explain how the bonding characteristics of carbon lead to a large variety of structures ranging from simple hydrocarbons to complex polymers and biological molecules.

[SC.912.P.10.1:](#)

Differentiate among the various forms of energy and recognize that they can be transformed from one form to others.

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|  | <p><b>Remarks/Examples:</b></p> <p>Differentiate between kinetic and potential energy. Recognize that energy cannot be created or destroyed, only transformed. Identify examples of transformation of energy: Heat to light in incandescent electric light bulbs<br/>Light to heat in laser drills Electrical to sound in radios<br/>Sound to electrical in microphones Electrical to chemical in battery rechargers Chemical to electrical in dry cells<br/>Mechanical to electrical in generators [power plants]<br/>Nuclear to heat in nuclear reactors Gravitational potential energy of a falling object is converted to kinetic energy then to heat and sound energy when the object hits the ground.</p> |
| <p><a href="#">SC.912.P.10.18:</a></p> | <p>Explore the theory of electromagnetism by comparing and contrasting the different parts of the electromagnetic spectrum in terms of wavelength, frequency, and energy, and relate them to phenomena and applications.</p> <p><b>Remarks/Examples:</b></p> <p>Describe the electromagnetic spectrum (i.e., radio waves, microwaves, infrared, visible light, ultraviolet, X-rays and gamma rays) in terms of frequency, wavelength and energy. Solve problems involving wavelength, frequency, and energy.</p>  |
| <p><a href="#">SC.912.P.12.12:</a></p> | <p>Explain how various factors, such as concentration, temperature, and presence of a catalyst affect the rate of a chemical reaction.</p> <p><b>Remarks/Examples:</b></p> <p>Various factors could include: temperature, pressure, solvent and/or solute concentration, sterics, surface area, and catalysts. The rate of reaction is determined by the activation energy, and the pathway of the reaction can be shorter in the presence of enzymes or catalysts. Examples may include: decomposition of hydrogen peroxide using manganese (IV) oxide nitration of benzene using concentrated sulfuric acid hydrogenation of a C=C double bond using nickel.</p>  |
| <p><a href="#">SC.912.L.14.2:</a></p>  | <p>Relate structure to function for the components of plant and animal cells. Explain the role of cell membranes as a highly selective barrier (passive and active transport).</p>  |
| <p><a href="#">SC.912.L.14.3:</a></p>  | <p>Compare and contrast the general structures of plant and animal</p>  |

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|                                 | <p>cells. Compare and contrast the general structures of prokaryotic and eukaryotic cells.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b></p> <p>Annually Assessed on Biology EOC. Also assesses <a href="#">SC.912.L.14.2</a>.</p> </div>  |
| <a href="#">SC.912.L.14.5:</a>  | <p>Explain the evidence supporting the scientific theory of the origin of eukaryotic cells (endosymbiosis).</p>   |
| <a href="#">SC.912.L.14.7:</a>  | <p>Relate the structure of each of the major plant organs and tissues to physiological processes.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b></p> <p>Annually Assessed on Biology EOC.</p> </div>  |
| <a href="#">SC.912.L.14.8:</a>  | <p>Explain alternation of generations in plants.</p>  |
| <a href="#">SC.912.L.14.9:</a>  | <p>Relate the major structure of fungi to their functions.</p>  |
| <a href="#">SC.912.L.14.10:</a> | <p>Discuss the relationship between the evolution of land plants and their anatomy.</p>   |
| <a href="#">SC.912.L.14.53:</a> | <p>Discuss basic classification and characteristics of plants. Identify bryophytes, pteridophytes, gymnosperms, and angiosperms.</p>  |
| <a href="#">SC.912.L.15.1:</a>  | <p>Explain how the scientific theory of evolution is supported by the fossil record, comparative anatomy, comparative embryology, biogeography, molecular biology, and observed evolutionary change.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b></p> <p>Annually Assessed on Biology EOC. Also assesses <a href="#">SC.912.L.15.10</a> <a href="#">SC.912.N.1.3</a> <a href="#">SC.912.N.1.4</a> <a href="#">SC.912.N.1.6</a> <a href="#">SC.912.N.2.1</a> <a href="#">SC.912.N.3.1</a> and <a href="#">SC.912.N.3.4</a>.</p> </div> |
| <a href="#">SC.912.L.15.3:</a>  | <p>Describe how biological diversity is increased by the origin of new species and how it is decreased by the natural process of extinction.</p>  |
| <a href="#">SC.912.L.15.4:</a>  | <p>Describe how and why organisms are hierarchically classified and based on evolutionary relationships.</p>  |
| <a href="#">SC.912.L.15.5:</a>  | <p>Explain the reasons for changes in how organisms are classified.</p>   |
| <a href="#">SC.912.L.15.6:</a>  | <p>Discuss distinguishing characteristics of the domains and kingdoms of living organisms.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b></p> <p>Annually Assessed on Biology EOC. Also assesses</p> </div>   |

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|                                 | <p><a href="#">SC.912.L.15.4</a> <a href="#">SC.912.L.15.5</a> <a href="#">SC.912.N.1.3</a> and <a href="#">SC.912.N.1.6</a>.</p>  |
|                                 | <p>Use Mendel's laws of segregation and independent assortment to analyze patterns of inheritance.</p>   |
| <a href="#">SC.912.L.16.1:</a>  | <p><b>Remarks/Examples:</b></p> <p>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.16.2</a>.</p>  |
| <a href="#">SC.912.L.16.2:</a>  | <p>Discuss observed inheritance patterns caused by various modes of inheritance, including dominant, recessive, codominant, sex-linked, polygenic, and multiple alleles.</p>   |
| <a href="#">SC.912.L.17.4:</a>  | <p>Describe changes in ecosystems resulting from seasonal variations, climate change and succession.</p>   |
| <a href="#">SC.912.L.17.6:</a>  | <p>Compare and contrast the relationships among organisms, including predation, parasitism, competition, commensalism, and mutualism.</p>  |
| <a href="#">SC.912.L.17.7:</a>  | <p>Characterize the biotic and abiotic components that define freshwater systems, marine systems and terrestrial systems.</p>  |
| <a href="#">SC.912.L.17.8:</a>  | <p>Recognize the consequences of the losses of biodiversity due to catastrophic events, climate changes, human activity, and the introduction of invasive, non-native species.</p>   |
|                                 | <p>Use a food web to identify and distinguish producers, consumers, and decomposers. Explain the pathway of energy transfer through trophic levels and the reduction of available energy at successive trophic levels.</p> |
| <a href="#">SC.912.L.17.9:</a>  | <p><b>Remarks/Examples:</b></p> <p>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.E.7.1</a>.</p>   |
| <a href="#">SC.912.L.17.10:</a> | <p>Diagram and explain the biogeochemical cycles of an ecosystem, including water, carbon, and nitrogen cycle.</p>   |
|                                 | <p>Describe the basic molecular structures and primary functions of the four major categories of biological macromolecules.</p>  |
| <a href="#">SC.912.L.18.1:</a>  | <p><b>Remarks/Examples:</b></p> <p>Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.18.11</a>.</p>   |
| <a href="#">SC.912.L.18.5:</a>  | <p>Discuss the use of chemiosmotic gradients for ATP production in chloroplasts and mitochondria.</p>  |
| <a href="#">SC.912.L.18.7:</a>  | <p>Identify the reactants, products, and basic functions of</p>  |



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|                                    | photosynthesis.  |
| <a href="#">SC.912.L.18.8:</a>     | Identify the reactants, products, and basic functions of aerobic and anaerobic cellular respiration.   |
| <a href="#">SC.912.L.18.9:</a>     | <p>Explain the interrelated nature of photosynthesis and cellular respiration.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/> Annually assessed on Biology EOC. Also assesses <a href="#">SC.912.L.18.7</a> <a href="#">SC.912.L.18.8</a> <a href="#">SC.912.L.18.10</a>.</p> </div>  |
| <a href="#">SC.912.L.18.10:</a>    | Connect the role of adenosine triphosphate (ATP) to energy transfers within a cell.  |
| <a href="#">SC.912.L.18.11:</a>    | Explain the role of enzymes as catalysts that lower the activation energy of biochemical reactions. Identify factors, such as pH and temperature, and their effect on enzyme activity.   |
| <a href="#">SC.912.L.18.12:</a>    | <p>Discuss the special properties of water that contribute to Earth's suitability as an environment for life: cohesive behavior, ability to moderate temperature, expansion upon freezing, and versatility as a solvent.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>Remarks/Examples:</b><br/> Annually assessed on Biology EOC.</p> </div>  |
| <a href="#">MAFS.912.N-Q.1.1:</a>  | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. ★  |
| <a href="#">MAFS.912.N-Q.1.3:</a>  | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. ★  |
| <a href="#">MAFS.912.F-IF.3.7:</a> | <p>Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★</p> <ol style="list-style-type: none"> <li>a. Graph linear and quadratic functions and show intercepts, maxima, and minima.</li> <li>b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.</li> <li>c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.</li> <li>d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.</li> </ol> |

- e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.

[LAFS.910.SL.1.2:](#)

Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.

[LAFS.910.SL.1.3:](#)

Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.

[LAFS.910.SL.2.4:](#)

Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

[LAFS.910.SL.2.5:](#)

Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.

[LAFS.1112.SL.1.1:](#)

Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

- a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.
- b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.
- c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.
- d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task.

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| <a href="#">LAFS.1112.SL.1.2:</a>  | Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.   |
| <a href="#">LAFS.1112.SL.1.3:</a>  | Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used.   |
| <a href="#">LAFS.1112.SL.2.4:</a>  | Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. |
| <a href="#">LAFS.1112.SL.2.5:</a>  | Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.   |
| <a href="#">LAFS.1112.RST.1.1:</a> | Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.  |
| <a href="#">LAFS.1112.RST.1.2:</a> | Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.   |
| <a href="#">LAFS.1112.RST.1.3:</a> | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.   |
| <a href="#">LAFS.1112.RST.2.4:</a> | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.  |
| <a href="#">LAFS.1112.RST.2.5:</a> | Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.   |
| <a href="#">LAFS.1112.RST.2.6:</a> | Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.   |
| <a href="#">LAFS.1112.RST.3.7:</a> | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.   |
| <a href="#">LAFS.1112.RST.3.8:</a> | Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and   |

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|                                     | corroborating or challenging conclusions with other sources of information.  |
| <a href="#">LAFS.1112.RST.3.9:</a>  | Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.  |
| <a href="#">LAFS.1112.RST.4.10:</a> | By the end of grade 12, read and comprehend science/technical texts in the grades 11–12 text complexity band independently and proficiently.   |
| <a href="#">LAFS.910.RST.1.1:</a>   | Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.   |
| <a href="#">LAFS.910.RST.1.3:</a>   | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.  |
| <a href="#">LAFS.910.RST.2.4:</a>   | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.  |
| <a href="#">LAFS.910.RST.2.5:</a>   | Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).  |
| <a href="#">LAFS.910.RST.3.7:</a>   | Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.   |
| <a href="#">LAFS.910.RST.3.9:</a>   | Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.   |
| <a href="#">LAFS.910.RST.4.10:</a>  | By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.  |
| <a href="#">LAFS.910.WHST.1.2:</a>  | Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. <ul style="list-style-type: none"> <li>a. Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.</li> <li>b. Develop the topic with well-chosen, relevant, and</li> </ul> |

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|  | <p>sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience’s knowledge of the topic.</p> <ul style="list-style-type: none"> <li>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts.</li> <li>d. Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.</li> <li>e. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.</li> <li>f. Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).</li> </ul>   |
| <p><a href="#">LAFS.910.WHST.3.9:</a></p>  | <p>Draw evidence from informational texts to support analysis, reflection, and research.</p>   |
| <p><a href="#">LAFS.1112.WHST.1.1:</a></p> | <p>Write arguments focused on <i>discipline-specific content</i>.</p> <ul style="list-style-type: none"> <li>a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.</li> <li>b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience’s knowledge level, concerns, values, and possible biases.</li> <li>c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.</li> <li>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.</li> <li>e. Provide a concluding statement or section that follows from or supports the argument presented.</li> </ul> |

Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

- a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.
- b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.
- c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.
- d. Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.
- e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic).

[LAFS.1112.WHST.1.2:](#)

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| <a href="#">LAFS.1112.WHST.2.4:</a> | Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.   |
| <a href="#">LAFS.1112.WHST.2.5:</a> | Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.   |
| <a href="#">LAFS.1112.WHST.2.6:</a> | Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.   |
| <a href="#">LAFS.1112.WHST.3.7:</a> | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. |
| <a href="#">LAFS.1112.WHST.3.8:</a> | Gather relevant information from multiple authoritative print  |

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|                                      | and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. |
| <a href="#">LAFS.1112.WHST.3.9:</a>  | Draw evidence from informational texts to support analysis, reflection, and research.   |
| <a href="#">LAFS.1112.WHST.4.10:</a> | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.  |
| <a href="#">ELD.K12.ELL.1.1:</a>     | English language learners communicate for social and instructional purposes within the school setting.  |
| <a href="#">ELD.K12.ELL.XX.1:</a>    | English language learners communicate information, ideas and concepts necessary for academic success in the content area of Science.  |
| <a href="#">LAFS.910.SL.1.1a:</a>    | Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.   |
| <a href="#">LAFS.910.SL.1.1b:</a>    | Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed.  |
| <a href="#">LAFS.910.SL.1.1c:</a>    | Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.  |
| <a href="#">LAFS.910.SL.1.1d:</a>    | Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.  |